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Ong

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(54) **METHODS AND SYSTEMS FOR WIRELESS COMMUNICATION**

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(51) **Int. Cl.**

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H04B 17/309	(2015.01)
H04W 52/50	(2009.01)
H04W 72/12	(2009.01)
H04W 52/38	(2009.01)

(52) **U.S. Cl.**

CPC ***H04W 52/241*** (2013.01); ***H04B 17/309*** (2015.01); ***H04W 52/245*** (2013.01); ***H04W 52/386*** (2013.01); ***H04W 52/50*** (2013.01); ***H04W 72/1231*** (2013.01)

(58) **Field of Classification Search**

CPC H04B 17/309; H04W 52/143; H04W 52/241; H04W 52/245; H04W 52/247; H04W 52/283; H04W 52/343; H04W 52/386; H04W 52/50; H04W 72/1231

USPC 455/69, 522, 67.14, 500; 370/216, 252, 370/312

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

7,652,982	B1 *	1/2010	Kovummal	H04L 49/552 370/216
10,110,396	B2	10/2018	Lee	
10,917,857	B2 *	2/2021	Ong	H04W 52/247
2006/0084400	A1	4/2006	Priotti et al.	
2008/0153423	A1 *	6/2008	Armstrong	H04B 17/309 455/67.14
2010/0017200	A1	1/2010	Oshikiri et al.	
2013/0273948	A1 *	10/2013	Tel-Or	H04B 7/2603 455/500
2013/0332150	A1	12/2013	Oshikiri et al.	
2014/0101758	A1 *	4/2014	Ludin	H04L 47/22 726/22
2015/0071368	A1	3/2015	Lau et al.	
2015/0098417	A1	4/2015	Hughes	
2015/0245236	A1 *	8/2015	Lu	H04W 52/241 370/252
2015/0304377	A1 *	10/2015	Chitrakar	H04L 65/4076 370/312

(Continued)

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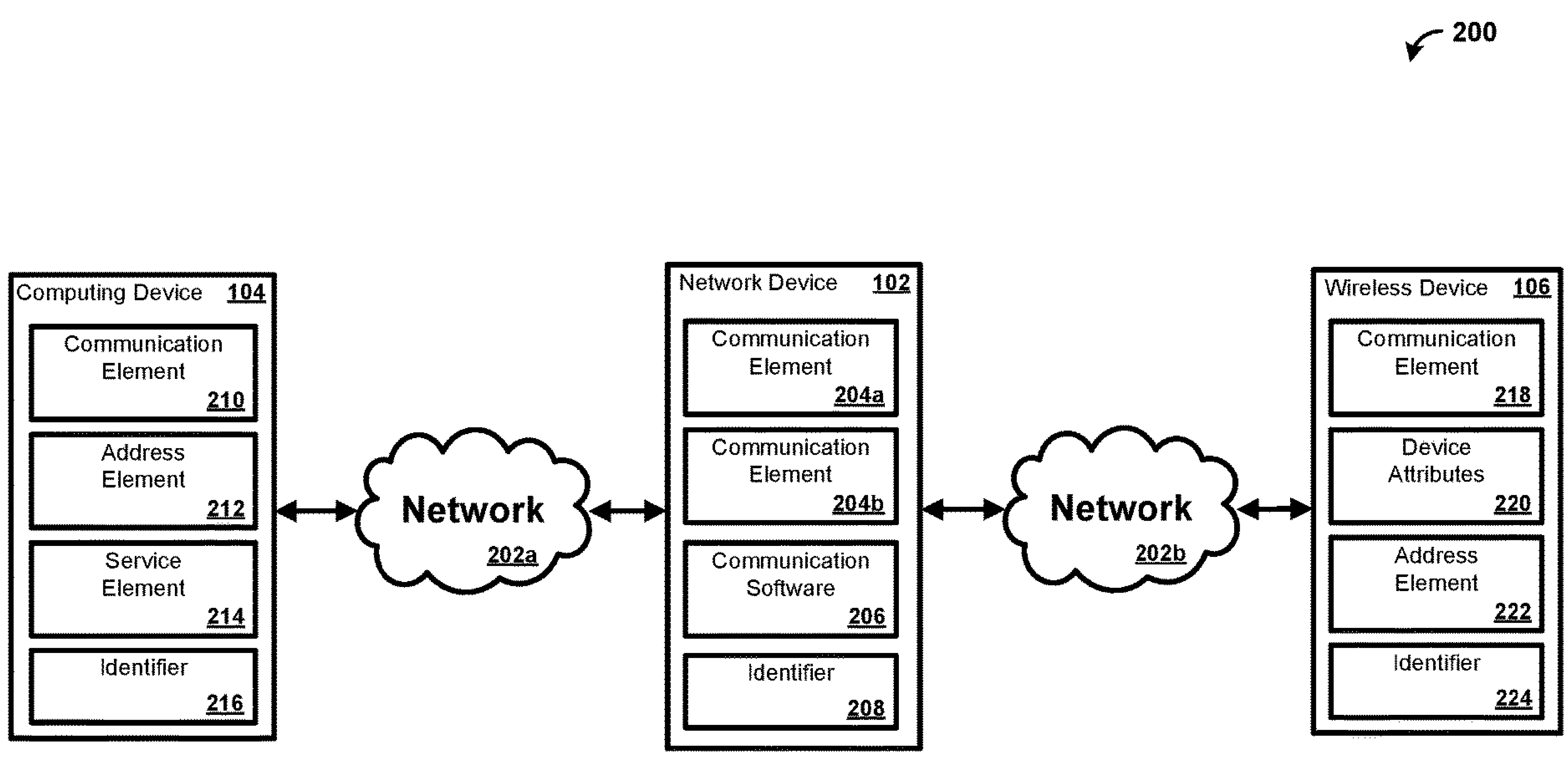
(57) **ABSTRACT**

Methods and systems for wireless communication are described. A computing device may receive data via a network. The computing device may modify one or more settings associated with a network based on the data.

43 Claims, 7 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

2015/0318945	A1	11/2015	Abdelmonem et al.	
2016/0037531	A1	2/2016	Lu et al.	
2016/0226732	A1*	8/2016	Kim	H04L 12/2807
2016/0316501	A1*	10/2016	Roe	H04W 12/50
2017/0212210	A1	7/2017	Chen et al.	
2017/0249007	A1*	8/2017	Hardin	G06F 1/3206
2017/0353516	A1*	12/2017	Gordon	H04L 67/02
2018/0035363	A1	2/2018	Gupta et al.	
2018/0103139	A1	4/2018	Griffin	
2018/0103392	A1*	4/2018	Emmanuel	H04B 17/345
2018/0115618	A1	4/2018	Park et al.	
2018/0263067	A1*	9/2018	Stephens	H04W 12/73
2019/0200363	A1*	6/2019	Rajendran	H04W 52/225
2019/0236203	A1*	8/2019	De Boer	G06F 16/328
2019/0312974	A1	10/2019	Soundar	
2020/0366468	A1*	11/2020	Khandani	H04L 69/161
2021/0105051	A1*	4/2021	Min	H04B 7/0617

* cited by examiner

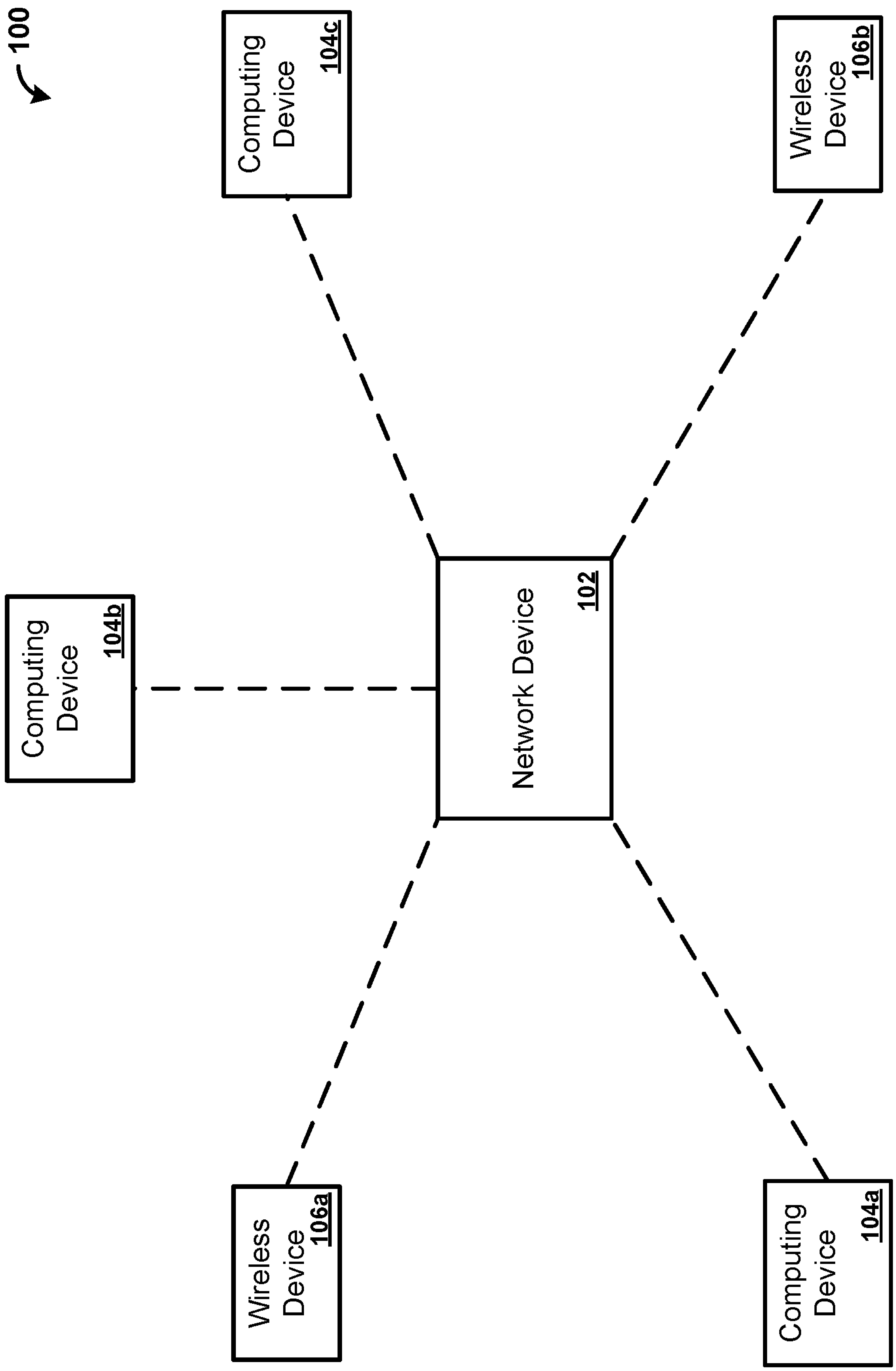

100
Computing Device 104c
Wireless Device 106b
Computing Device 104b
Network Device 102
Wireless Device 106a
Computing Device 104a

FIG. 1

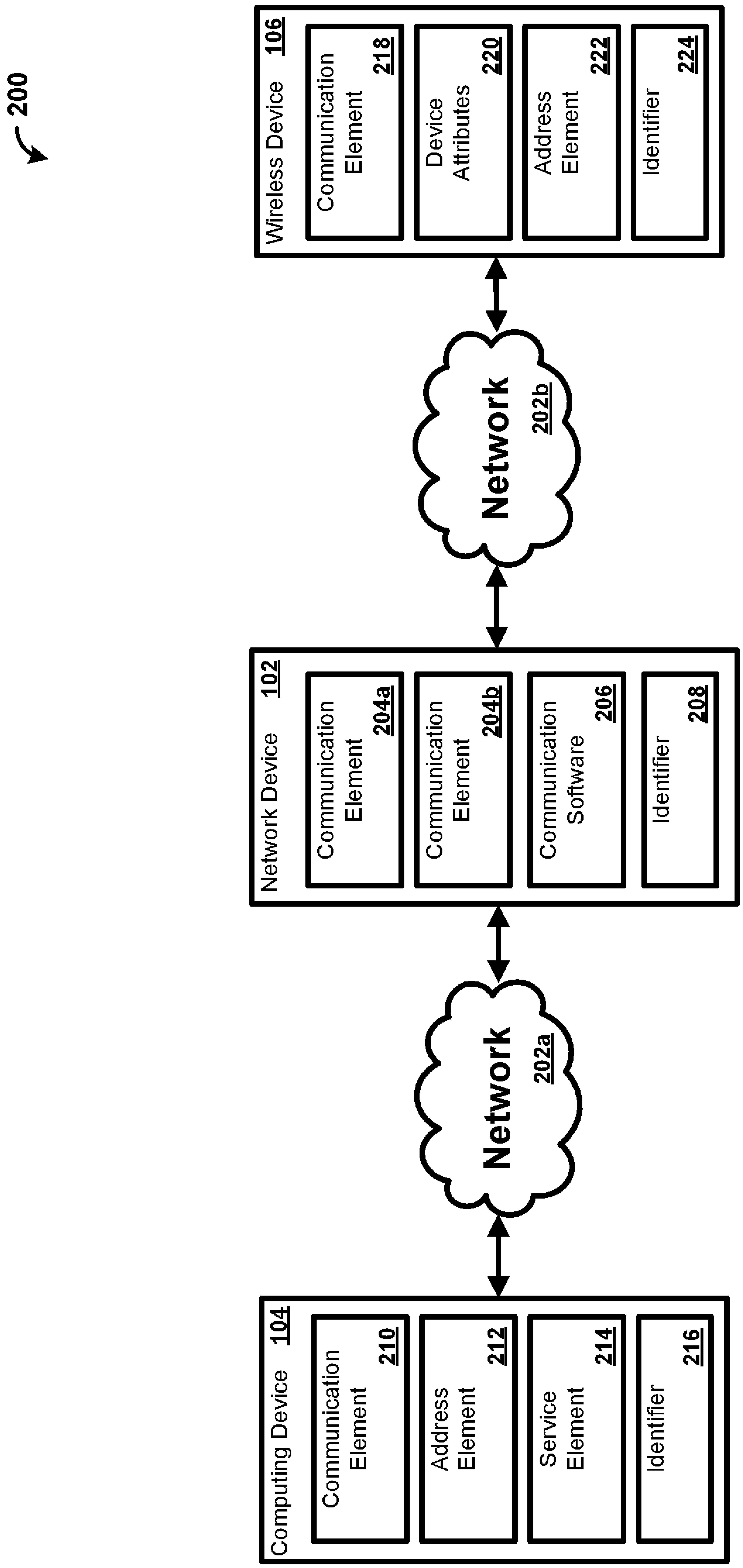

200
Wireless Device 106
Communication Element 218
Device Attributes 220
Address Element 222
Identifier 224
Network 202b
Network Device 102
Communication Element 204a
Communication Element 204b
Communication Software 206
Identifier 208
Network 202a
Computing Device 104
Communication Element 210
Address Element 212
Service Element 214
Identifier 216

FIG. 2

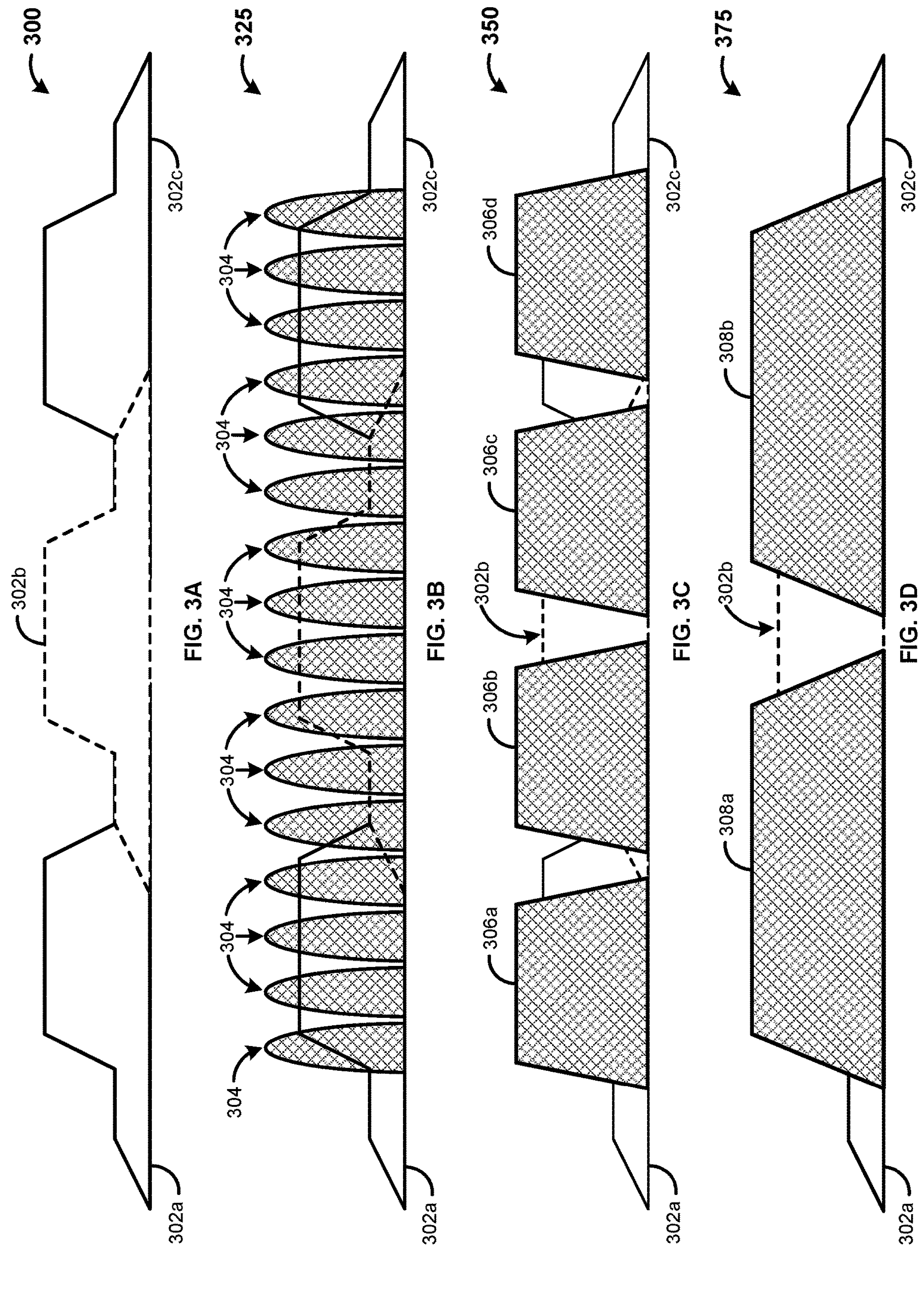


FIG. 3A

FIG. 3B

FIG. 3C

FIG. 3D

FIG. 4

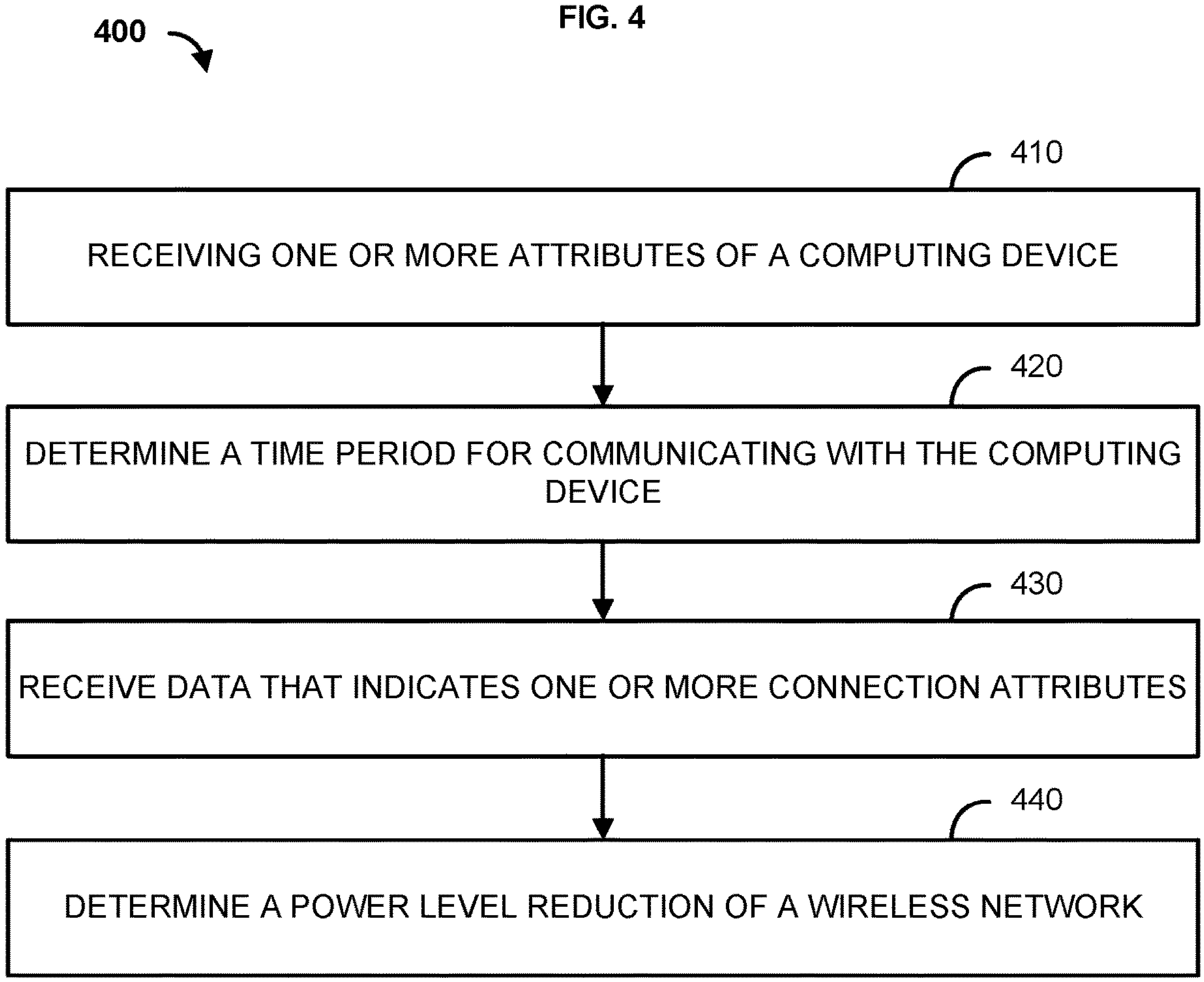

400
410
RECEIVING ONE OR MORE ATTRIBUTES OF A COMPUTING DEVICE
420
DETERMINE A TIME PERIOD FOR COMMUNICATING WITH THE COMPUTING DEVICE
430
RECEIVE DATA THAT INDICATES ONE OR MORE CONNECTION ATTRIBUTES
440
DETERMINE A POWER LEVEL REDUCTION OF A WIRELESS NETWORK

FIG. 5

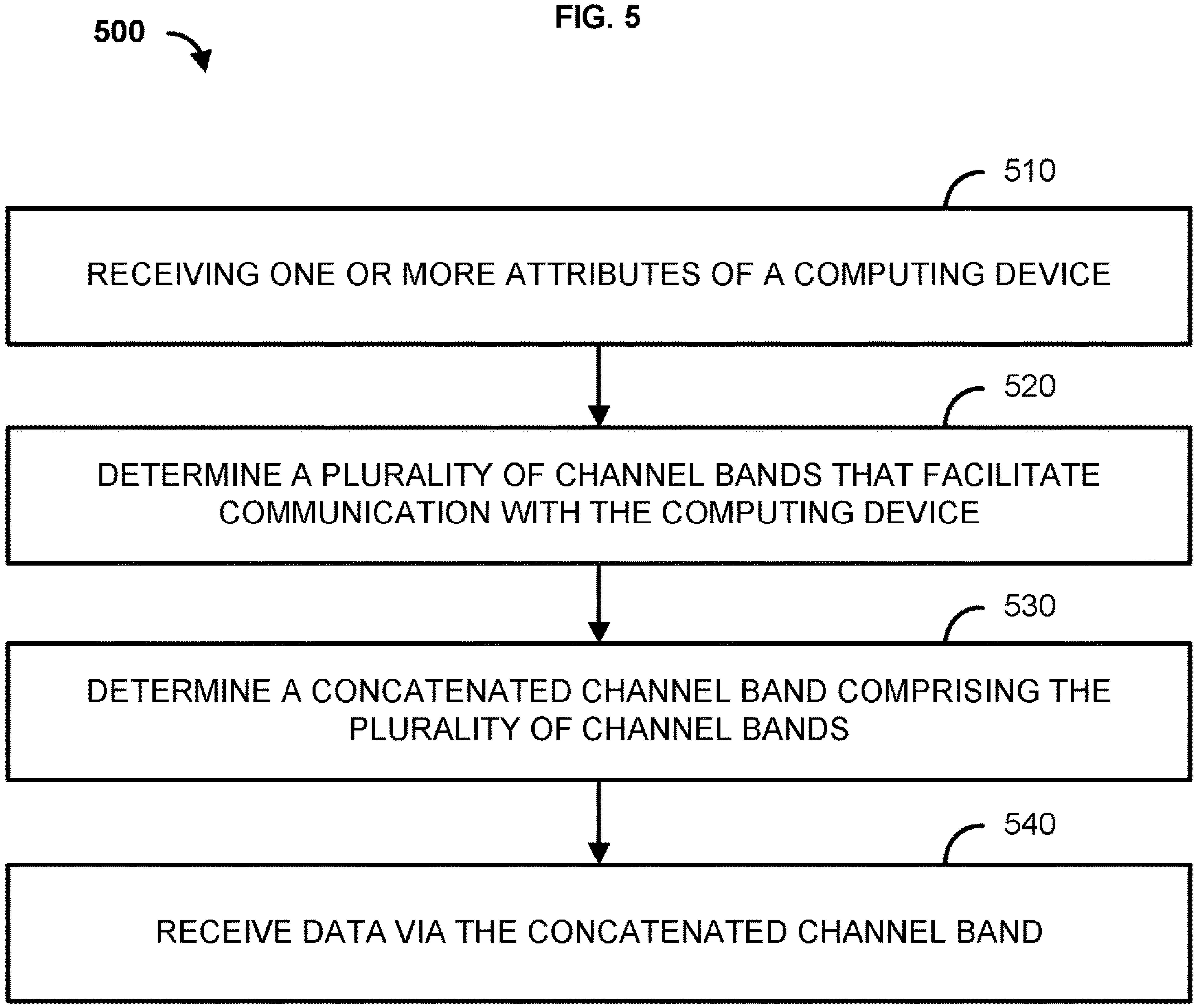
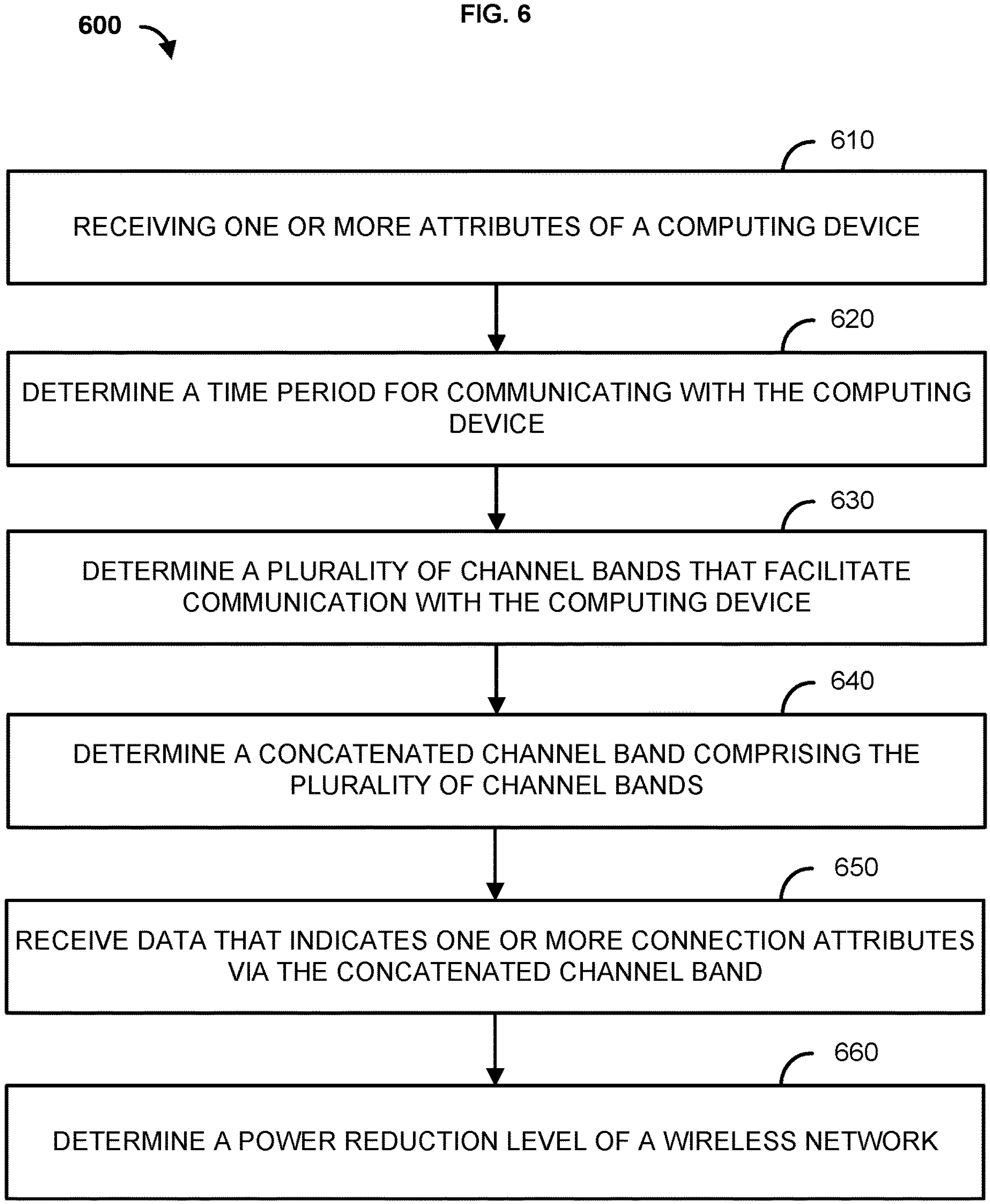

500
510
RECEIVING ONE OR MORE ATTRIBUTES OF A COMPUTING DEVICE
520
DETERMINE A PLURALITY OF CHANNEL BANDS THAT FACILITATE COMMUNICATION WITH THE COMPUTING DEVICE
530
DETERMINE A CONCATENATED CHANNEL BAND COMPRISING THE PLURALITY OF CHANNEL BANDS
540
RECEIVE DATA VIA THE CONCATENATED CHANNEL BAND

FIG. 6


600
610
RECEIVING ONE OR MORE ATTRIBUTES OF A COMPUTING DEVICE
620
DETERMINE A TIME PERIOD FOR COMMUNICATING WITH THE COMPUTING DEVICE
630
DETERMINE A PLURALITY OF CHANNEL BANDS THAT FACILITATE COMMUNICATION WITH THE COMPUTING DEVICE
640
DETERMINE A CONCATENATED CHANNEL BAND COMPRISING THE PLURALITY OF CHANNEL BANDS
650
RECEIVE DATA THAT INDICATES ONE OR MORE CONNECTION ATTRIBUTES VIA THE CONCATENATED CHANNEL BAND
660
DETERMINE A POWER REDUCTION LEVEL OF A WIRELESS NETWORK

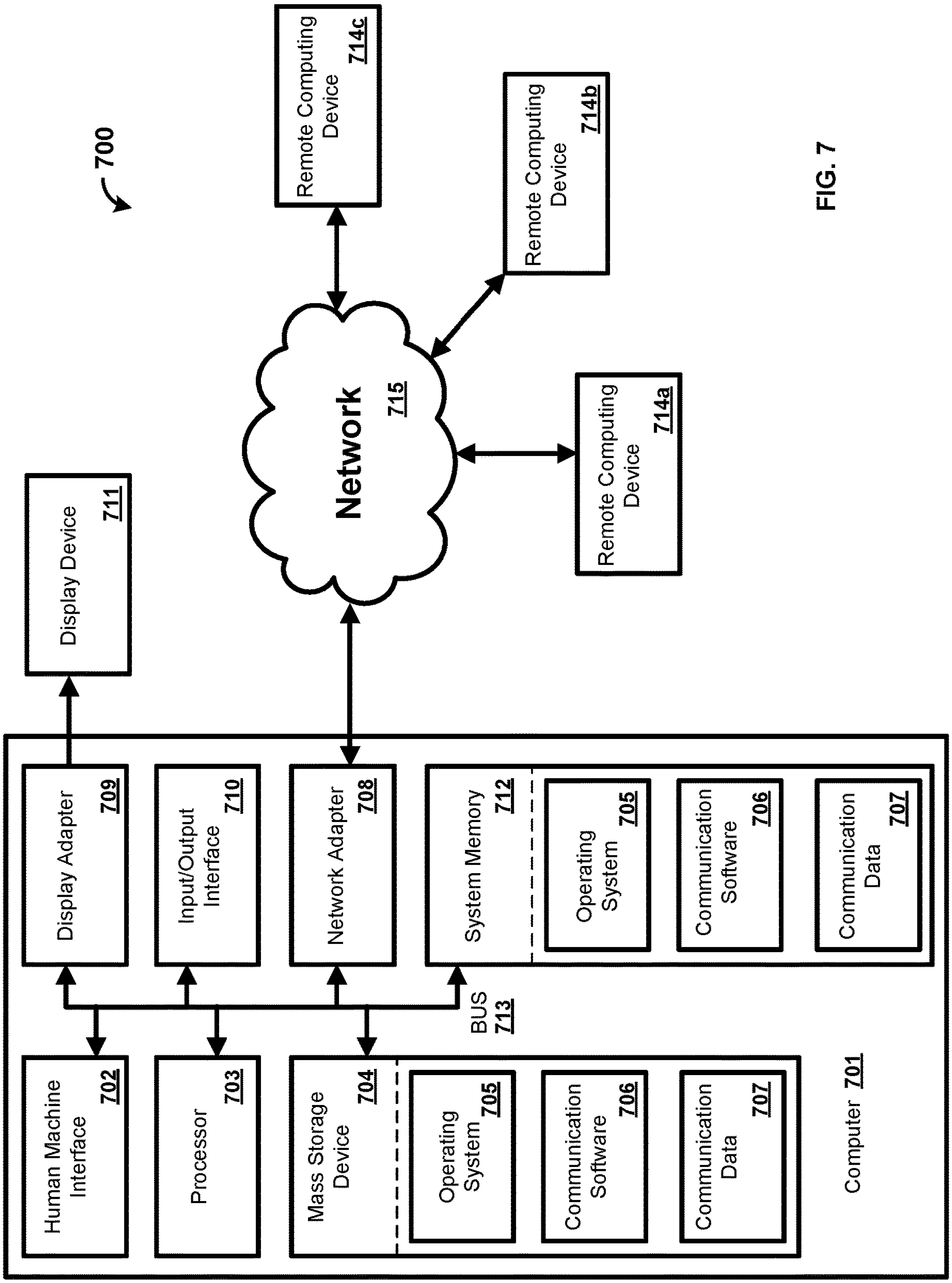

700
Remote Computing Device 714c
Remote Computing Device 714b
Remote Computing Device 714a
Network 715
Display Device 711
Display Adapter 709
Input/Output Interface 710
Network Adapter 708
System Memory 712
Operating System 705
Communication Software 706
Communication Data 707
BUS 713
Human Machine Interface 702
Processor 703
Mass Storage Device 704
Operating System 705
Communication Software 706
Communication Data 707
Computer 701

FIG. 7

METHODS AND SYSTEMS FOR WIRELESS COMMUNICATION

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 16/388,611, filed on Apr. 18, 2019, the entire contents of which are incorporated herein by reference in its entirety.

BACKGROUND

As more electronic devices utilize communication networks (e.g., wireless communication networks), the communication networks may become more congested with communication traffic. Further, multiple electronic devices may send electronic communications via the same communication channel, which may result in increased interference. For example, Wi-Fi typically operates in one or more bands (e.g., 2.4 GHz, 5 GHz, etc.), and electronic devices that utilize Wireless Personal Area Networks (WPANs), such as ZigBee, may also utilize the 2.4 GHz band. However, when two electronic devices communicate on the same band, interference may occur with the communications such that one device's communication may be over powered by the other device's communication. For example, electronic devices that utilize WPANs may be low powered devices, such as Internet of Things (IoT) devices, which have low powered communications. Thus, the communications from IoT devices may be overpowered by the communications from Wi-Fi devices when both the IoT devices and the Wi-Fi devices utilize the same wireless band.

SUMMARY

It is to be understood that both the following general description and the following detailed description are exemplary and explanatory only and are not restrictive. Methods and systems for wireless communication are described. A wireless device (e.g., an IoT device) may communicate with a network device (e.g., a gateway, a router, etc.) to pair the wireless device with the network device directly or via a wireless network. The wireless device may provide the network device with one or more characteristics of the wireless device to facilitate communication with the network device. The wireless device may communicate with the network device via a first wireless network. The network device may utilize the characteristics of the wireless device to determine a time period that the wireless device may communicate with the network device via the first wireless network. The network device may receive connection characteristics from the wireless device. The network device may receive the connection characteristics after the wireless device's location has changed. The network device may modify a power level of a second wireless network based on the connection characteristics after the wireless device's location has changed. The network device may reduce the power level of the second wireless network during the time period to improve the ability of the network device to receive communications from the wireless device. Further, the network device may concatenate one or more communication bands to improve the ability of the network device to receive communications from the wireless device. This summary is not intended to identify critical or essential features of the disclosure, but merely to summarize certain features and variations thereof. Other details and features will be described in the sections that follow.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are incorporated in and constitute a part of this specification, show examples and together with the description, serve to explain the principles of the methods and systems:

FIG. **1** shows an example system for wireless communication;

FIG. **2** shows an example system for wireless communication;

FIGS. **3**A-**3**D show example diagrams of wireless communication channels;

FIG. **4** shows a flowchart of an example method for wireless communication;

FIG. **5** shows a flowchart of an example method for wireless communication;

FIG. **6** shows a flowchart of an example method for wireless communication; and

FIG. **7** shows a block diagram of an example computing device for wireless communication.

DETAILED DESCRIPTION

As used in the specification and the appended claims, the singular forms "a," "an," and "the" include plural referents unless the context clearly dictates otherwise. Ranges may be expressed herein as from "about" one particular value, and/or to "about" another particular value. When such a range is expressed, another configuration includes from the one particular value and/or to the other particular value. Similarly, when values are expressed as approximations, by use of the antecedent "about," it will be understood that the particular value forms another configuration. It will be further understood that the endpoints of each of the ranges are significant both in relation to the other endpoint, and independently of the other endpoint.

"Optional" or "optionally" means that the subsequently described event or circumstance may or may not occur, and that the description includes cases where said event or circumstance occurs and cases where it does not.

Throughout the description and claims of this specification, the word "comprise" and variations of the word, such as "comprising" and "comprises," means "including but not limited to," and is not intended to exclude, for example, other components, integers or steps. "Exemplary" means "an example of" and is not intended to convey an indication of a preferred or ideal configuration. "Such as" is not used in a restrictive sense, but for explanatory purposes.

It is understood that when combinations, subsets, interactions, groups, etc. of components are described that, while specific reference of each various individual and collective combinations and permutations of these may not be explicitly described, each is specifically contemplated and described herein. This applies to all parts of this application including, but not limited to, steps in described methods. Thus, if there are a variety of additional steps that may be performed it is understood that each of these additional steps may be performed with any specific configuration or combination of configurations of the described methods.

As will be appreciated by one skilled in the art, hardware, software, or a combination of software and hardware may be implemented. Furthermore, a computer program product on a computer-readable storage medium (e.g., non-transitory) having processor-executable instructions (e.g., computer software) embodied in the storage medium. Any suitable computer-readable storage medium may be utilized including hard disks, CD-ROMs, optical storage devices, magnetic storage devices, memresistors, Non-Volatile Random Access Memory (NVRAM), flash memory, or a combination thereof.

Throughout this application reference is made block diagrams and flowcharts. It will be understood that each block of the block diagrams and flowcharts, and combinations of blocks in the block diagrams and flowcharts, respectively, may be implemented by processor-executable instructions. These processor-executable instructions may be loaded onto a general purpose computer, special purpose computer, or other programmable data processing apparatus to produce a machine, such that the processor-executable instructions which execute on the computer or other programmable data processing apparatus create a device for implementing the functions specified in the flowchart block or blocks.

These processor-executable instructions may also be stored in a computer-readable memory that may direct a computer or other programmable data processing apparatus to function in a particular manner, such that the processor-executable instructions stored in the computer-readable memory produce an article of manufacture including processor-executable instructions for implementing the function specified in the flowchart block or blocks. The processor-executable instructions may also be loaded onto a computer or other programmable data processing apparatus to cause a series of operational steps to be performed on the computer or other programmable apparatus to produce a computer-implemented process such that the processor-executable instructions that execute on the computer or other programmable apparatus provide steps for implementing the functions specified in the flowchart block or blocks.

Accordingly, blocks of the block diagrams and flowcharts support combinations of devices for performing the specified functions, combinations of steps for performing the specified functions and program instruction means for performing the specified functions. It will also be understood that each block of the block diagrams and flowcharts, and combinations of blocks in the block diagrams and flowcharts, may be implemented by special purpose hardware-based computer systems that perform the specified functions or steps, or combinations of special purpose hardware and computer instructions.

This detailed description may refer to a given entity performing some action. It should be understood that this language may in some cases mean that a system (e.g., a computer) owned and/or controlled by the given entity is actually performing the action.

When a network device (e.g., a gateway, a router, an access point, etc.) utilizes more than one communication protocol, problems may arise when attempting to utilize one or more radios concurrently. For example, under normal usage of a Wi-Fi network, some communication protocols may be adversely affected because the communication protocols are low powered compared to Wi-Fi. One method for improving the communication capabilities of the low powered protocols is to have a designated time period (e.g., a quiet time) that the Wi-Fi devices are not communicating on the Wi-Fi network so that the low powered protocol has a clean (e.g., noise free) time window to communicate with the network device. However, this may negatively impact a user's experience when utilizing the Wi-Fi network. Further, this approach may be extremely resource intensive and waste resources because the Wi-Fi quiet time occurs irrespective of the time of day and does not take into account the utilization of the Wi-Fi network.

A wireless network device may pair with a wireless device (e.g., an Internet of Things (IoT) device). During the pairing process, the wireless network device and the wireless device may determine a polling time for the wireless device to communicate with the wireless network device. The communications between the wireless device and the wireless network device may have one or more connection attributes, such as a Link Quality Indicator (LQI), a Relative Received Signal Strength (RSSI), a Packet Error Rate (PER), and the like. If the one or more connection attributes change (e.g., if a location of a wireless device changes), the changed connection attributes may be factored into a polling frequency, as well as an adjustment to the power level of a wireless network (e.g., Wi-Fi) associated with the wireless network device to accommodate receiver sensitivity for the wireless device. Thus, the communications from the wireless device may have better noise isolation, and the ability for the wireless network device to receive communications from the wireless device may be increased.

The wireless network device may concatenate one or more bands of a wireless network to improve the signal to noise ratio of communications from the wireless device. A wireless network may have one or more communication bands. For example, a Wireless Personal Area Network (WPAN), such as ZigBee, may have one or more communications bands. The bands may each have an associated width (e.g., 2 MHz wide). Further, each of these bands may be spaced a certain value apart. For example, the bands may be 5 MHz apart. In comparison, a Wi-Fi network may have bands that are 20 MHz or 40 MHz wide that operate on the same channel as the WPAN. Thus, if the WPAN and Wi-Fi network are communicating concurrently, the communications of the WPAN may be very noisy due to the low signal bandwidth as compared to the Wi-Fi network. Accordingly, the communications of the WPAN network may not be received by the wireless network device when a Wi-Fi communication is actively transmitting on the Wi-Fi network since the Wi-Fi network and the WPAN network may utilize the same channel. While a Wi-Fi network and a WPAN network have been described for ease of explanation, a person skilled in the art would appreciate that interference may occur between any wireless communication operating on the same wireless band. Thus, the present disclosure should not be limited to the aforementioned examples.

To improve the ability for the wireless network device to receive communications via a first wireless network, the wireless network device may concatenate two or more bands of the first wireless network when the wireless network device is not actively transmitting via the first wireless network. By concatenating two or more bands of the first wireless network, the concatenated bands have a larger bandwidth which may be approximately as wide as a second wireless network band to improve the Signal to Noise Ratio (SNR) of the first wireless band. Further, concatenating bands of the first wireless network will not disrupt other networks (e.g., the second wireless network) because it is a passive mechanism (e.g., a mechanism that does not require an active reduction of the second wireless network) that is employed when the wireless network device is in a receive mode to counter coexistence of the first wireless network and the second wireless network. When the wireless network device sends (e.g., transmits) a communication via the first wireless network, the wireless network device may only send the communication on one channel of the first wireless network, instead of the concatenated band.

For example, the wireless network device may concatenate two or more bands of a WPAN when the wireless network device is not actively transmitting via the WPAN. That is, the wireless network device may concatenate two or more bands of the WPAN when the wireless network device is listening and/or receiving communications via the WPAN. By concatenating two or more bands of the WPAN, the concatenated bands have a larger bandwidth which may be approximately as wide as a Wi-Fi band to improve the Signal to Noise Ratio (SNR) of the WPAN. Further, concatenating bands of the WPAN will not disrupt other networks (e.g., the Wi-Fi network) because it is a passive mechanism (e.g., a mechanism that does not require an active reduction of the Wi-Fi network) that is employed when the wireless network device is in a receive mode to counter coexistence of the WPAN and the Wi-Fi network. When the wireless network device sends (e.g., transmits) a communication via the WPAN, the wireless network device may only send the communication on one channel of the WPAN, instead of the concatenated band.

FIG. **1** shows an example system **100** for wireless communication. Those skilled in the art will appreciate that digital equipment and/or analog equipment may be employed. One skilled in the art will appreciate that provided herein is a functional description and that the respective functions may be performed by software, hardware, or a combination of software and hardware.

The system **100** may have a network device **102**, computing devices **104**, and/or wireless devices **106**. Specifically, the system **100** has computing devices **104***a,b,c* and wireless devices **106***a,b*. As will be appreciated by one skilled in the art, the system **100** may have any quantity of network devices **102**, computing devices **104**, and wireless devices **106**. The network device **102** may be a wireless communication device (e.g., a wireless router, a gateway, an access point, etc.). The network device **102** may utilize two or more communication protocols to communicate on two or more wireless networks. The network device **102** may have two more radio transceivers for utilizing the two or more communication protocols. A first wireless network and a second wireless network may communicate via the same channel. For example, the network device **102** may utilize a Wi-Fi communication protocol and may utilize a Wireless Personal Area Network (WPAN) protocol to provide two separate communication networks. The WPAN may be a ZigBee network. The Wi-Fi network and the WPAN may communicate via the same channel (e.g., a 2.4 GHz channel). The network device **102** may be configured with a first Service Set Identifier (SSID) (e.g., associated with a user network or private network) to function as a local network for a particular user or users. The network device **102** may be configured with a second SSID (e.g., associated with a public/community network or a hidden network) to function as a secondary network or redundant network for connected communication devices.

The computing devices **104***a,b,c* may be an electronic device such as a computer, a smartphone, a laptop, a tablet, a set top box, a display device, or other device capable of communicating with the network device **102**. The computing devices **104** may communicate with the network device **102** via a wireless communication network (e.g., Wi-Fi, Bluetooth, etc.). The computing devices **104** may utilize the wireless network to communicate with the network device **102**. The computing devices **104** may communicate via the network device **102** to access a service, such as the Internet.

The wireless devices **106***a,b* may be any electronic device such as a computer, a smartphone, a laptop, a tablet, a set top box, a display device, and/or a low powered electronic device (e.g., an IoT device) such as a sensor, a smart device, a security system (e.g., electronic camera, smart doorbell, etc.), and so forth. The wireless devices **106** may utilize a first wireless network (e.g., a WPAN and/or Wi-Fi network) to communicate with the network device **102**. The wireless devices **106** may pair with the network device **102**. The wireless devices **106** may pair with the network device **102** prior to communicating via the first wireless network (e.g., the WPAN and/or Wi-Fi network). The wireless devices **106** may provide one or more communication characteristics and/or attributes of the wireless devices **106** to the network device **102**, such as Link Quality Indicator (LQI), Relative Received Signal Strength (RSSI), Packet Error Rate (PER), and so forth. The wireless devices **106** may provide the one or more communication characteristics and/or attributes of the wireless devices **106** to the network device **102** during the pairing process.

The wireless devices **106** may provide the network device **102** with a time period that the wireless devices **106** may send a communication to the network device **102**. The wireless devices **106** may communicate with the network device **102** to determine the time period that the wireless devices **106** may send a communication to the network device **102**. The communication may be one or more data packets sent from the wireless device **106** to the network device **102**, such as a heartbeat signal. The network device **102** may keep track of (e.g., store in a data structure) a time period associated with each wireless device **106** that has paired with (e.g., registered with) the network device **102**. The network device **102** may determine a time for each wireless device **106** to communicate with the network device **102**. The network device **102** may determine, based on the time period, a time for each wireless device **106** to communicate with the network device **102**. The network device **102** may ensure that no two wireless devices **106** are communicating during the same time period in order to avoid any interference between the communications of the wireless devices **106**. That is, the network device **102** may determine non-overlapping time periods for each wireless device **106** to communicate with the network device **102**. One or more of the wireless devices **106** may not be capable of modifying the time period that the wireless device **106** sends the communication to the network device **102**. Accordingly, the network device **102** may only modify the time period of wireless devices **106** that are capable of modifying the time period that the wireless device **106** communicates with the network device **102**.

After pairing with the network device **102**, the wireless devices **106** may communicate with the network device **102** via the first wireless network. After pairing with the network device **102**, a location of the wireless devices **106** may change. That is, during pairing, the wireless devices **106** may be placed close (e.g., a few inches, a foot, etc.) to the network device **102** to improve the pairing process. However, the final location of the wireless devices **106** may be further away from the network device **102**, such as placed throughout a user's home. Thus, the communication characteristics may change based on the final location of the wireless devices **106**. Accordingly, the network device **102** may modify and/or update one or more settings of one or more of the communication networks associated with the network device **102** based on the final location of the wireless devices **106**.

The network device **102** may adjust one or more settings (e.g., a power level) of a wireless network associated with the network device **102**. The network device **102** may adjust one or more settings of a first wireless network and/or a second wireless network. For example, the network device **102** may adjust one or more settings of the Wi-Fi network and/or the WPAN network. The network device **102** may adjust one or more settings of the wireless communication based on the final location of one or more of the wireless devices **106**. The network device **102** may reduce a power level of one of the one or more wireless networks. For example, the network device **102** may reduce a power level of a signal and/or a communication associated with the wireless network. The network device **102** may reduce the power level of the wireless network during a time period that one or more of the wireless devices **106** may communicate with the network device **102**. The network device **102** may determine the time period for when each wireless device **106** may communicate with the network device **102**. The network device **102** may determine a window of time to adjust the one or more settings of the wireless network. The network device **102** may determine the window of time to adjust the one or more settings of the wireless network based on the time period when the wireless devices **106** communicate with the network device **102**. The window of time may be any period of time (e.g., 1 ms, 5 ms, etc.). The window of time may be centered around the time period when the wireless devices **106** communicate with the network device **102**. For example, if the wireless device **106***a* communicates with the network device **102** every 20 ms, the network device **102** may adjust the one or more settings of the wireless network from every 18 ms to 22 ms. Stated differently, the network device **102** may adjust the one or more settings of the wireless network at 18 ms, and then may adjust the one or more settings of the wireless network back to normal (e.g., the one or more settings standard operational value) 4 ms later at 22 ms. Thus, the window of time may be 4 ms (e.g., from 18 ms to 22 ms).

The network device **102** may adjust the time period that the wireless devices **106** communicate with the network device **102**. The network device **102** may adjust the time period that the wireless devices **106** communicate with the network device **102** based on a signal strength of communications received from one or more of the wireless devices **106**. The network device may increase (e.g., lengthen) the time period that a wireless device **106** communicates with the network device **102**. The network device **102** may increase the time period that the wireless device **106** communicates with the network device **102** to reduce the number of communications sent by the wireless device **106** to the network device **102**. By reducing the number of communications sent by the wireless device **106** to the network device **102**, power of the wireless device **106** may be conserved. By conserving the power of the wireless device **106**, the wireless device **106** may increase the power per communication sent. By increasing the power per communication sent by the wireless device **106**, the communications may have an increased chance of being received by the network device **102**. The network device **102** may decrease (e.g., shorten) the time period that the wireless device **106** communicates with the network device **102** to increase the number of communications sent by the wireless device **106** to the network device **102**. The network device **102** may also increase or decrease the time period based on a utilization of a wireless network (e.g., the Wi-Fi network and/or the WPAN network). While the network device **102** has been described as adjusting the time period for ease of explanation, the wireless device **106** may have the same capabilities described above.

The network device **102** may reduce the power level of the first network during the time period that one or more of the wireless devices **106** may communicate with the network device **102** utilizing the second wireless network. For example, the network device **102** may reduce a power level associated with a signal associated with the first wireless network and/or a power level of a communication associated with the first wireless network. The network device **102** may reduce the power level of the first wireless network based on the communication characteristics associated with one or more of the wireless devices **106**. The network device **102** may reduce the power level of the first wireless network based on a signal strength of communications received from one or more of the wireless devices **106**. The network device **102** may reduce the power level of the first wireless network based on a distance of one or more of the wireless devices **106** from the network device **102**. That is, the further the final location of a wireless device **106** is from the network device **102**, the network device **102** may further reduce the power level of the first wireless network to ensure the wireless device **106** is capable of communicating with the network device **102** via the second wireless network. The network device **102** may modify one or more channels of the first wireless network to avoid conflict with the second wireless network. The network device **102** may reduce the channel bandwidth of the first wireless network. The reduction in the channel bandwidth may increase frequency separation to improve the wireless devices **106** ability to communicate on the second wireless network.

For example, the network device **102** may reduce the power level of the Wi-Fi network during the time period that one or more of the wireless devices **106** may communicate with the network device **102**. The network device **102** may reduce the power level of the Wi-Fi network based on the communication characteristics associated with one or more of the wireless devices **106**. The network device **102** may reduce the power level of the Wi-Fi network based on a signal strength of communications received from one or more of the wireless devices **106**. The network device **102** may reduce the power level of the Wi-Fi network based on a distance of one or more of the wireless devices **106** from the network device **102**. That is, the further the final location of a wireless device **106** is from the network device **102**, the network device **102** may further reduce the power level of the Wi-Fi network to ensure the wireless device **106** is capable of communicating with the network device **102** over the WPAN network. The network device **102** may modify one or more channels of the Wi-Fi network to avoid conflict with the WPAN. The network device **102** may reduce the channel bandwidth of the Wi-Fi network. The reduction in the channel bandwidth may increase frequency separation to improve the wireless devices **106** ability to communicate on the WPAN. For example, the network device **102** may reduce the channel bandwidth from 40 MHz to 20 MHz.

The network device **102** may modify the reduction of the power level of the first wireless network based on when a wireless device **106** is communicating with the network device **102**. For example, the network device **102** may modify the reduction of the power level of the Wi-Fi network based on when a wireless device **106** is communicating with the network device **102** (e.g., via the WPAN). Each wireless device **106** may communicate with the network device **102** at different times. The network device **102** may determine a power level reduction for each wireless device **106**. The power level reduction may be based on the time period that the wireless device **106** may communicate with the network device **102**. The network device **102** may modify the power level of the first wireless network based on which wireless device **106** may be communicating with the network device **102** during the time period. For example, the network device **102** may modify the power level of the Wi-Fi network based on which wireless device **106** may be communicating with the network device **102** during the time period. The power level reduction for each wireless device **106** may be unique. While the power level reduction for each wireless device **106** may be unique, the power level reduction may be the same for two or more wireless devices **106**. The power level reduction may be based on one or more communication characteristics of the communication between the network device **102** and each wireless device **106**.

The network device **102** may determine a window of time to reduce the power level of the first wireless network. The network device **102** may determine the window of time to adjust reduce the power level of the first wireless network based on the time period when the wireless devices **106** communicate with the network device **102** via the second wireless network. For example, the network device **102** may determine the window of time to adjust (e.g., reduce) the power level of the Wi-Fi network based on the time period when the wireless devices **106** communicate with the network device **102** via the WPAN. The window of time may be any period of time (e.g., 1 ms, 5 ms, etc.). The window of time may be centered around the time period when the wireless devices **106** communicate with the network device **102**. For example, if the wireless device **106*a*** communicates with the network device **102** every 20 ms, the network device **102** may reduce the power level of the first wireless network from every 18 ms to 22 ms. Stated differently, the network device **102** may reduce the power level of the first wireless network at 18 ms, and then may adjust the power level of the first wireless network back to normal (e.g., the one or more settings standard operational value) 4 ms later at 22 ms. Thus, the window of time may be 4 ms (e.g., from 18 ms to 22 ms).

The wireless device **106*a*** may communicate with the network device **102** every 10 ms. The network device **102** may determine a power level of the first wireless network for when the wireless device **106*a*** may communicate with the network device **102** (e.g., every 10 ms). The network device **102** may determine a power level reduction of the first wireless network for the time period that the wireless device **106*a*** may communicate with the network device **102**. The network device **102** may determine a window of time to reduce the power level of the first wireless network. The window of time may be based on the time period that the wireless device **106*a*** may communicate with the network device **102**.

The wireless device **106*a*** may send data to the network device **102**. The data may indicate a signal strength associated with the communication between the network device **102** and the wireless device **106*a***. The network device **102** may determine, based on the signal strength, a power level reduction of the first wireless network. For example, the network device **102** may determine that the power level of the Wi-Fi network may need to be reduced 20% based on the signal strength. The network device **102** may reduce the power level of the Wi-Fi network by 20% when the wireless device **106*a*** communicates with the network device **102**. The network device **102** may determine that the power level of the first wireless network may need to be reduced by 45% based on a signal strength associated with the communication from the wireless device **106*b*** via the second wireless network. For example, the network device **102** may reduce the power level of the Wi-Fi network by 45% when the wireless device **106*b*** communicates with the network device **102** via the WPAN.

The network device **102** may determine a power level reduction and a time period for the power level reduction for each wireless device **106** paired with the network device **102**. The network device **102** may determine a respective power level reduction, a respective time period for the power level reduction, and a respective window of time to reduce the power level of the first wireless network for each wireless device **106** paired with the network device **102**. For example, the network device **102** may determine a respective power level reduction, a respective time period for the power level reduction, and a respective window of time to reduce the power level of the Wi-Fi network for each wireless device **106** paired with the network device **102**.

The network device **102** may reduce the power level of the first wireless network a first power level reduction (e.g., 20%) during a time period that the wireless device **106*a*** may communicate with the network device **102** via the second wireless network. For example, the wireless device **106*a*** may communicate every 10 ms with the network device **102**. The network device **102** may determine to modify the power level of the Wi-Fi network 20% every 10 ms to improve communication with the wireless device **106*a*** via the second wireless network (e.g., the WPAN).

The network device **102** may determine a window of time to reduce the power level of the first wireless network. The network device **102** may determine to reduce the power level of the first wireless network for a 4 ms window of time. For example, the network device may determine to reduce the power level of the Wi-Fi network from 8 ms to 12 ms (e.g., a 4 ms window of time every 10 ms). The network device may determine to reduce the power level of the Wi-Fi network 20% from 8 ms to 12 ms to improve communications with the wireless device **106*a*** via the second wireless network (e.g., the WPAN). The network device **102** may reduce the power level of the first wireless network a second power level reduction (e.g., 45%) during a time period that the wireless device **106*b*** may communicate with the network device **102**. For example, the wireless device **106*b*** may communicate every 15 ms with the network device **102**. The network device **102** may determine to modify the power level of the Wi-Fi network 45% every 15 ms to improve communication with the wireless device **106*b*** via the second wireless network (e.g., the WPAN). The network device **102** may determine a window of time to reduce the power level of the first wireless network. The network device **102** may determine to reduce the power level of the first wireless network for a 2 ms window of time. The network device may determine to reduce the power level of the first wireless network from 14 ms to 16 ms (e.g., a 1 ms window of time every 15 ms). The network device may determine to reduce the power level of the first wireless network 45% from 14 ms to 16 ms to improve communications with the network device **106*b*** via the second wireless network.

The network device **102** may dynamically modify the power level of the first wireless network (e.g., a Wi-Fi network) during the time period that one or more of the wireless devices **106** may communicate with the network device **102** via the second wireless network (e.g., a WPAN). The network device **102** may dynamically modify the power level of the first wireless network based on usage of the first wireless network. The network device **102** may increase or decrease the power level of the first wireless network based on usage of the first wireless network. The network device **102** may determine a network utilization of the first wireless network. The network device **102** may determine the network utilization of the first wireless network based on a usage of the first wireless network by the computing devices **104**. The network device **102** may determine the network utilization of the first wireless network based on the available bandwidth of the first wireless network. If the computing devices **104** are heavily using the first wireless network (e.g., performing bandwidth intensive tasks such as streaming high definition content), the network device **102** may not reduce the power level of the first wireless network in order to ensure that a user utilizing the computing devices **104** does not have a negative experience while heavily using the first wireless network. The network device **102** may modify the reduction of the power level of the first wireless network based on the usage of the first wireless network by the computing devices **104**. The network device **102** may reduce the power level of the first wireless network if the computing devices **104** are not utilizing a large portion of the first wireless network bandwidth in order to improve communications with the wireless devices **106**.

The network device **102** may determine to not reduce the power level of the first wireless network during a first time period that one or more of the wireless devices **106** may communicate with the network device **102** via the second wireless network. For example, the network device **102** may determine to not reduce the power level of the Wi-Fi network during a first time period that one or more of the wireless devices **106** may communicate with the network device **102** via the WPAN. The wireless devices **106** may send a quantity (e.g., 2, 3, 5, 20, etc.) of communications (e.g., during a first time period, a second time period after the first time period, and so forth) without receiving a confirmation from the network device **102**. The wireless devices **106** may not send a communication if the quantity of communications satisfies a threshold. The quantity of communications satisfying the threshold may indicate an error associated with the communication network. The wireless devices **106** may determine after the quantity of communications are sent that an error has occurred with the second wireless network such that the wireless devices **106** should not continue attempting to send communications via the second wireless network.

The network device **102** may determine the quantity of attempts that the wireless devices **106** may attempt to communicate with the network device **102** before the wireless devices **106** cease attempting to communicate with the network device **102**. The network device **102** may determine the quantity of attempts to communicate based on pairing with the wireless devices **106**. The network device **102** may determine to not modify the power level of the first wireless network (e.g., a Wi-Fi network) based on a quantity of communications received from a wireless device **106** via a second wireless network (e.g., a WPAN). That is, the network device **102** may determine to ignore one or more communications from the wireless device **106** by not reducing a power level of the first wireless network when the wireless device **106** may attempt to communicate with the network device **102**. The network device **102** may dynamically determine to not modify the power level of the first wireless network based on a quantity of communications received from a wireless device **106** (e.g., via the second wireless network) and a usage of the first wireless network.

The network device **102** may utilize a data structure to determine the quantity of communications from a wireless device **106** that the network device **102** may ignore (e.g., not respond to). The network device **102** may determine a quantity of time periods that the network device **102** may not reduce the power level of the first wireless (e.g., a Wi-Fi network) based on the quantity of communications that the wireless device **106** may send before the wireless device **106** will halt communications. For example, the network device **102** may determine that a wireless device **106** will make three separate attempts to communicate with the network device **102** via the second wireless network (e.g., the WPAN) before halting communications. The network device **102** may determine that the network device **102** may ignore (e.g., not respond to) two communications from the wireless device **106** before the wireless device **106** stops communicating with the network device **102**. The network device **102** may determine the time periods associated with the two communications from the wireless device **106**. The network device **102** may determine, based on the time periods, a period of time the network device **102** may ignore (e.g., not respond to) communications from the wireless device **106**. Accordingly, the network device **102** may not reduce power level of the first wireless network (e.g., the Wi-Fi network) during the time period that the network device **102** may ignore the wireless device **106** in order to ensure the best possible bandwidth for the first wireless network, while also preventing the wireless device **106** from determining that the wireless device **106** should stop communicating with the network device **102**.

The network device **102** may concatenate one or more bands of the second wireless network. For example, the network device **102** may concatenate one or more bands of a WPAN. The bands of the second wireless network may be smaller bands as compared to bands of the first wireless network. For example, the bands of the WPAN may be smaller (e.g., 5 MHz bands) as compared to a Wi-Fi band (e.g., 20 MHz bands). Thus, the bands of the second wireless network may be difficult for the network device **102** to discern when communications on the second wireless network (e.g., the WPAN) and the first wireless network (e.g., the Wi-Fi network) are occurring concurrently. For example, the larger Wi-Fi bands may increase the interference with the WPAN bands if the two networks communicate concurrently as the Wi-Fi bands and WPAN bands utilize the same channel. The network device **102** may concatenate one or more bands of the second wireless network to create a new band to improve the ability for the network device **102** to receive communications from the wireless devices **106**. The network device **102** may concatenate a predetermined quantity of bands of the second wireless network such that the concatenated band has approximately the same bandwidth as a band of the first wireless network. For example, the network device **102** may concatenate a predetermined quantity of bands of the WPAN such that the concatenated band has approximately the same bandwidth as a Wi-Fi band. Thus, the concatenated band of the second wireless network would have a similar bandwidth of the first wireless network band which would improve the Signal to Noise Ratio (SNR) of the concatenated second wireless network band compared to the non-concatenated second wireless network bands. By improving the SNR of the second wireless network communications, the network device **102** may improve the ability of the network device **102** to receive communications from the wireless devices **106**.

The network device **102** may concatenate the one or more bands only when the network device **102** is not actively transmitting a communication on the second wireless network (e.g., the WPAN). That is, the network device **102** may concatenate the one or more bands of the second wireless network when listening for a communication from the wireless devices **106**, but the network device **102** may utilize a single unconcatenated band of the second wireless network to transmit a communication to the wireless devices **106**. By utilizing a single band of the second wireless network for sending a communication, the network device **102** may reduce the impact on the first wireless network (e.g., the Wi-Fi network).

FIG. **2** shows an example system **200** for wireless communication. Those skilled in the art will appreciate that digital equipment and/or analog equipment may be employed. One skilled in the art will appreciate that provided herein is a functional description and that the respective functions may be performed by software, hardware, or a combination of software and hardware.

The system **200** may have a network device **102**, a computing device **104**, and a wireless device **106**. The network device **102** may facilitate the connection of a device, such as the computing device **104** and/or the wireless device **106**, to a network (e.g., the networks **202**). The network device **102** may communicate with the computing device **104** via a first network **202***a*, and the network device **102** may communicate with the wireless device **106** via a second network **202***b*. The first network **202***a* may be a Wi-Fi network, and the second network **202***b* may be a WPAN (e.g., a ZigBee network).

The network device **102** may be configured as a local area network (LAN). The network device **102** may be a dual band wireless communication device. The network device **102** may be a gateway device for communicating with another network, such as a communication network provided by an Internet Service Provider. The network device **102** may be configured with a first service set identifier (SSID) (e.g., associated with a user network or private network) to function as a local network for a particular user or users. The network device **102** may be configured with a second service set identifier (SSID) (e.g., associated with a public/community network or a hidden network) to function as a secondary network or redundant network for connected communication devices. The network device **102** may be configured to allow one or more wireless devices to connect to a wired and/or wireless network using Wi-Fi, Bluetooth or any desired method or standard.

The network device **102** may have communication elements **204***a,b*, communication software **206**, and an identifier **208**. The communication elements **204***a,b* may be wireless transceivers configured to transmit and receive wireless communications via a wireless network (e.g., the networks **202***a,b*). The communication elements **204***a,b* may be configured to communicate via a specific network protocol. For example, the communication element **204***a* may be a wireless transceiver configured to communicate via a Wi-Fi network, and the communication element **204***b* may be a wireless transceiver configured to communicate via a WPAN. The network device **102** may communicate with the computing device **104** on the network **202***a* via the communication element **204***a*. The network device **102** may communicate with the wireless device **106** on the network **202***b* via the communication element **204***b*.

The network device **102** may have communication software **206**. The communication software **206** may be any combination of firmware, software, and/or hardware. The communication software **206** may pair the network device **102** with the wireless device **106**. That is, the communication software **206** may facilitate an initial handshake between the network device **102** and the wireless device **106** in order to facilitate the network device **102** communicating with the wireless device **106** via the network **202***b*. The communication software **206** may determine one or more attributes of the wireless device **106** (e.g., the device attributes **220**). The communication software **206** may determine a time period that the wireless device **106** may send a communication to the network device **102**.

The communication software **206** may modify and/or update one or more settings of one or more of the communication networks associated with the network device **102** (e.g., the network **202***a*) based on one or more communication attributes of the wireless device **106**. The communication software **206** may adjust one or more settings of the network **202***a* based on the one or more communication attributes of the wireless device **106**. For example, the communication software **206** may modify a power associated with the network **202***a* based on the one or more communication attributes of the wireless device **106**. The communication software **206** may reduce the power level of the network **202***a* during a time period that the wireless device **106** may communicate with the network device **102** via the network **202***b*. That is, the communication software **206** may reduce the power provided to and/or output by the communication element **204***a*. The communication software **206** may reduce the power level of the network **202***a* based on a range (e.g., a distance from) of the wireless device **106** from the network device **102**. That is, the further the wireless device **106** is from the network device **102**, the communication software may increase the amount of power reduction of the network **202***a* to ensure the wireless device **106** is capable of communicating with the network device **102**. The communication software **206** may modify a channel associated with the network **202***a*, and/or reduce a bandwidth of a channel associated with the network **202***a*.

The communication software **206** may dynamically modify the power level of the network **202***a* based on usage of the network **202***a*. If the computing device **104** is heavily using the network **202***a* (e.g., performing bandwidth intensive tasks such as streaming high definition content), the communication software **206** may not reduce the power level of the network **202***a* in order to ensure that a user utilizing the computing device **104** does not have a negative experience while heavily using the network **202***a*. The communication software **206** may increase the power level of the network **202***a* during the heavy usage of the network **202***a* to improve the experience of a user associated with the computing device **104**. The communication software **206** may reduce the power level of the network **202***a* if the computing device **104** is not utilizing a large portion of the network **202***a* in order to improve communications with the wireless device **106** via the network **202***b*. That is, the communication software **206** may determine that a power level of the network **202***a* may be reduced without impacting any computing devices **104** communicating view the network **202***a*.

The communication software **206** may dynamically modify the power level of the network **202***a* during the time period that one or more of the wireless devices **106** may communicate with the network device **102**. The communication software **206** may dynamically modify the power level of the network **202***a* based on usage of the network **202***a*. The communication software **206** may increase or decrease the power level of the network **202***a* based on usage of the network **202***a*. The communication software **206** may determine a network utilization of the network **202***a*. The communication software **206** may determine the network utilization of the network **202***a* based on a usage of the network **202***a* by the computing device **104**. The communication software **206** may determine the network utilization of the network **202***a* based on the available bandwidth of the network **202***a*. If the computing device **104** is heavily using the network **202***a* (e.g., performing bandwidth intensive tasks such as streaming high definition content), the communication software **206** may not reduce the power level of the network **202***a* in order to ensure that a user utilizing the computing device **104** does not have a negative experience while heavily using the network **202***a*. The communication software **206** may modify the reduction of the power level of the network **202***a* based on the usage of the network **202***a* by the computing device **104**. The communication software **206** may reduce the power level of the network **202***a* if the computing device **104** is not utilizing a large portion of the bandwidth of the network **202***a* in order to improve communications with the wireless devices **106**.

The communication software **206** may determine to not reduce the power level of the network **202***a* during a first time period that one or more of the wireless devices **106** may communicate with the network device **102** via the network **202***b*. The wireless device **106** may send a quantity (e.g., 2, 3, 5, 20, etc.) of communications (e.g., during a first time period, a second time period after the first time period, and so forth) without receiving a confirmation from the network device **102**. The wireless device **106** may not send a communication if the quantity of communications satisfies a threshold. The quantity of communications satisfying the threshold may indicate an error associated with the communication network. The wireless device **106** may determine after the predetermined quantity of communications are sent that an error has occurred with the network **202***b* such that the wireless devices **106** should not continue attempting to send communications via the network **202***b*. The communication software **206** may determine the quantity of attempts that the wireless devices **106** may attempt to communicate with the network device **102** before the wireless devices **106** cease attempting to communicate with the network device **102**.

The communication software **206** may determine the quantity of attempts based on pairing with the wireless device **106**. The communication software **206** may determine to not modify the power level of the network **202***a* based on a quantity of communications received from a wireless device **106**. The communication software **206** may dynamically determine to not modify the power level of the network **202***a* based on a quantity of communications received from a wireless device **106** and a usage of the network **202***a*. The communication software **206** may utilize a data structure that has the quantity of communications that the wireless device **106** will attempt to communicate with the network device **102**. The communication software **206** may utilize the data structure to determine the quantity of communications from the wireless device **106** that the network device **102** may ignore (e.g., not respond to). The communication software **206** may determine a quantity of time periods that the communication software **206** may not reduce the power level of the network **202***a* based on the quantity of communications that the wireless device **106** may send. The communication software **206** may determine that a wireless device **106** will make three separate attempts to communicate with the network device **102** before halting communications. The communication software **206** may determine that the network device **102** may ignore (e.g., not respond to) two communications from the wireless device **106** before the wireless device **106** stops communicating. The communication software **206** may determine the time periods associated with the two communications from the wireless device **106**. The communication software **206** may determine, based on the time periods, a period of time the network device **102** may ignore (e.g., not respond to) communications from the wireless device **106**. Accordingly, the communication software **206** may not reduce power level of the network **202***a* during the time period that the network device **102** may ignore the wireless device **106** in order to ensure the best possible bandwidth for the network **202***a*, while also preventing the wireless device **106** from determining the wireless device **106** should stop communicating with the network device **102** via the network **202***b*.

The communication software **206** may concatenate one or more bands of a wireless network. The communication software **206** may concatenate one or more bands of the network **202***b* (e.g., the WPAN). The bands of the network **202***b* may be smaller (e.g., 5 MHz bands) as compared to the network **202***a* (e.g., 20 MHz bands, 40 MHz bands, etc.). Thus, the bands of the network **202***b* may be difficult for the network device **102** to discern when communications on the network **202***b* and the network **202***a* are occurring concurrently. The communication software **206** may concatenate one or more bands of the network **202***b* to create a new band with greater bandwidth to improve the ability for the network device **102** to receive communications from the wireless device **106**. The communication software **206** may concatenate a predetermined quantity of bands of the network **202***b* such that the concatenated band has approximately the same bandwidth as a band of the network **202***a*. Thus, the concatenated band of the network **202***b* would have a similar bandwidth as the band of the network **202***a* which would improve the Signal to Noise Ratio (SNR) of the concatenated band of the network **202***b* compared to the non-concatenated bands of the network **202***b*.

The communication software **206** may concatenate the one or more bands only when the communication element **204***b* is not actively transmitting a communication on the network **202***b*. That is, the communication software **206** may concatenate the one or more bands of the network **202***b* when listening for a communication from the wireless device **106**, but the communication element **204***b* may utilize a single unconcatenated band of the network **202***b* to transmit a communication to the wireless device **106**. By utilizing a single band of the network **202***b*, the communication software **206** may reduce the impact on the network **202***a*.

The network device **102** may have an identifier **208**. The identifier **208** may be or relate to an Internet Protocol (IP) Address IPV4/IPV6 or a media access control address (MAC address) or the like. The identifier **208** may be a unique identifier for facilitating wired and/or wireless communications with the network device **102**. The identifier **208** may be associated with a physical location of the network device **102**.

The computing device **104** may have a communication element **210**, an address element **212**, a service element **214**, and an identifier **216**. The computing device **104** may be an electronic device such as a computer, a smartphone, a laptop, a tablet, a set top box, a display device, or other device capable of communicating with the network device **102**. The communication element **210** may be a wireless transceiver configured to transmit and receive wireless communications via a wireless network (e.g., the network **202***a*). The communication element **210** may be configured to communicate via one or more wireless networks. The communication element **210** may be configured to communicate via a specific network protocol. The communication element **210** may be a wireless transceiver configured to communicate via a Wi-Fi network (e.g., network **202***a*). The computing device **104** may communicate with the network device **102** on the network **202***a* via the communication element **210**.

The computing device **104** may have an address element **212** and a service element **214**. The address element **212** may comprise or provide an internet protocol address, a network address, a media access control (MAC) address, an Internet address, or the like. The address element **212** may be relied upon to establish a communication session between the computing device **104** and the network device **102** or other devices and/or networks. The address element **212** may be used as an identifier or locator of the computing device **104**. The address element **212** may be persistent for a particular network (e.g., the network **202***a*).

The service element **214** may comprise an identification of a service provider associated with the computing device **104** and/or with the class of computing device **104**. The class of the computing device **104** may be related to a type of device, capability of device, type of service being provided, and/or a level of service (e.g., business class, service tier, service package, etc.). The service element **214** may comprise information relating to or provided by a communication service provider (e.g., Internet service provider) that is providing or enabling data flow such as communication services to the computing device **104**. The service element **214** may comprise information relating to a preferred service provider for one or more particular services relating to the computing device **104**. The address element **212** may be used to identify or retrieve data from the service element **214**, or vice versa. The one or more of the address element **212** and the service element **214** may be stored remotely from the computing device **104**. Other information may be represented by the service element **214**.

The computing device **104** may be associated with a user identifier or device identifier **216**. The device identifier **216** may be any identifier, token, character, string, or the like, for differentiating one user or computing device (e.g., the computing device **104**) from another user or computing device. The device identifier **216** may identify a user or computing device as belonging to a particular class of users or computing devices. The device identifier **216** may comprise information relating to the computing device **104** such as a manufacturer, a model or type of device, a service provider associated with the computing device **104**, a state of the computing device **104**, a locator, and/or a label or classifier. Other information may be represented by the device identifier **216**.

The wireless device **106** may have a communication element **218**, device attributes **220**, an address element **222**, and an identifier **224**. The wireless device **106** may be an electronic device such as a sensor, smart TV, smart speakers, toys, wearable electronics, smart appliance, smart meters, security systems, or other devices capable of communicating with the network device **102**. The communication element **218** may be a wireless transceiver configured to transmit and receive wireless communications via a wireless network (e.g., the networks **202***b*). The communication element **218** may be configured to communicate via one or more wireless networks. The communication element **218** may be configured to communicate via a specific network protocol. The communication element **218** may be a wireless transceiver configured to communicate via a WPAN (e.g., the network **202***b*) such as a ZigBee network. The wireless device **106** may communicate with the network device **102** on the network **202***b* via the communication element **218**.

The wireless device **106** may have device attributes **220**. The device attributes **220** may indicate one or more attributes about the wireless device **106**, such as operating characteristics of the wireless device **106**. The device attributes **220** may indicate Link Quality Indicator (LQI), Relative Received Signal Strength (RSSI), Packet Error Rate (PER), channel selection, potential bands for use by the wireless device **106**, channels the wireless device **106** may avoid communicating on, frequency of heartbeat, sleep duration, and so forth. The device attributes **220** may indicate how the wireless device **106** operates. That is, the device attributes **220** may indicate the time period that the wireless device **106** will communicate with the network device **102**. Further, the device attributes **220** may indicate a power and/or a range associated with the communication element **218**. The wireless device **106** may provide the device attributes **220** to the network device **102** to facilitate the network device **102** communicating with the wireless device **106** via the network **202***b*.

The wireless device **106** may have an address element **222**. The address element **222** may comprise or provide an internet protocol address, a network address, a media access control (MAC) address, an Internet address, or the like. The address element **222** may be relied upon to establish a communication session between the wireless device **106** and the network device **102** via the network **202***b* or other devices and/or networks. The address element **222** may be used as an identifier or locator of the wireless device **106**. The address element **222** may be persistent for a particular network (e.g., the network **202***b*).

The wireless device **106** may be associated with a user identifier or device identifier **224**. The device identifier **224** may be any identifier, token, character, string, or the like, for differentiating one user or wireless device (e.g., the wireless device **106**) from another user or wireless device. The device identifier **224** may identify a user or wireless device **106** as belonging to a particular class of users or wireless devices **106**. The device identifier **224** may comprise information relating to the wireless device **106** such as a manufacturer, a model or type of device, a service provider associated with the wireless device **106**, a state of the wireless device **106**, a locator, and/or a label or classifier. Other information may be represented by the device identifier **224**.

FIGS. **3**A-**3**D show example diagrams of wireless communication channels. FIG. **3**A shows a diagram **300** having three Wi-Fi bands **302***a,b,c*. The Wi-Fi bands may each have an associated width. For example, the Wi-Fi bands **302***a,b,c* may be 20 MHz wide, 40 MHz wide, or any width. FIG. **3**B shows a diagram **325** having the three Wi-Fi bands **302***a,b,c* of FIG. **3**A overlaid with a plurality of WPAN bands **304**. The plurality of WPAN bands **304** may contain the same total bandwidth of the Wi-Fi bands **302***a,b,c*. The Wi-Fi bands **302***a,b,c* and the WPAN bands **304** may operate on the same frequency (e.g., 2.4 GHz). The WPAN bands **304** may have an associated width and may be spaced a distance apart. For example, the WPAN bands **304** may be 2 MHz wide and may be spaced 5 MHz apart. Based on the relatively small size of the WPAN bands **304** as compared to the Wi-Fi bands **302***a,b,c*, the WPAN bands **304** will have a much higher Signal to Noise Ratio (SNR) than the Wi-Fi bands **302***a,b,c* when the WPAN and the Wi-Fi network are communicating concurrently. To improve the SNR, the WPAN bands **304** may be concatenated together. FIG. **3**C shows a diagram **350** of concatenated WPAN bands **306***a, b,c,d*. The concatenated WPAN bands **306***a,b,c,d* are the WPAN bands **304** that have been concatenated into larger WPAN bands. Thus, the concatenated WPAN bands **306***a, b,c,d* have a higher SNR as compared to the WPAN bands **304**. FIG. **3**D shows a diagram **375** of concatenated WPAN bands **308***a,b*. The concatenated WPAN bands **308***a,b* are the WPAN bands **306***a,b,c,d* that have been concatenated into larger WPAN bands. Thus, the concatenated WPAN bands **308***a,b* have a higher SNR as compared to the WPAN bands **306***a,b,c,d*.

FIG. **4** is a flowchart of an example method **400** for wireless communication. At step **410**, a computing device (e.g., the computing device **104** and/or the wireless device **106** of FIGS. **1** & **2**) may receive one or more attributes of another computing device and/or a network device (e.g., the network device **102** of FIGS. **1** & **2**). For example, the computing device may pair with the another computing device and/or a network device (e.g., the network device **102** of FIGS. **1** & **2**). A pairing request may be received by the network device from the computing device. The pairing request may initiate the pairing. The pairing may occur via a first wireless network (e.g., via the networks **202***a,b* of FIG. **2**). The first wireless network may be a WPAN network. For example, the WPAN network may be a ZigBee network. The pairing may occur via another communication protocol such as Near Field Communication (NFC). One or more attributes (e.g., the device attributes **220** of FIG. **2**) of the computing device may be received during the pairing. The one or more attributes of the computing device may be received by the network device during the pairing.

At step **420**, a time period for communicating with the computing device may be determined. The network device may determine the time period for communicating with the computing device. The time period for communicating with the computing device may be based on the one or more attributes of the computing device received during the pairing. The time period may be based on a time that the computing device will transmit a heartbeat signal. The time period may be associated with the first wireless network.

At step **430**, data that indicates one or more connection attributes (e.g., the connection attributes **220** of FIG. **2**) may be received. The network device may receive the data that indicates the one or more connection attributes. The network device may receive the data that indicates the one or more connection attributes from the computing device. The network device may receive the data from the computing device via the first wireless network. The data may be received during the determined time period. The data may indicate one or more connection attributes associated with the transmission of the data. The one or more connection attributes may be a Link Quality Indicator (LQI), a Relative Received Signal Strength (RSSI), or a Packet Error Rate (PER).

At step **440**, a power level reduction of a wireless network may be determined. The power level reduction of the wireless network may be determined by the network device. The power level reduction may be of the second wireless network. The power level reduction may be of a signal and/or communication associated with the second wireless network. The power level reduction may be configured to occur during the determined time period. The power level reduction may be dynamically determined. The power level reduction may be based on a bandwidth of the second wireless network during the time period. The power level reduction may be based on a quantity of computing devices communicating via the second wireless network. The power level reduction may be based on a quantity of computing devices communicating via the second wireless network during the determined time period. The second wireless network may be a Wi-Fi network. The network device may modify a power level associated with the second wireless network during the time period. The network device may reduce the power level of the second wireless network during the determined time period. The network device may receive data that indicates a communication (e.g., from the computing device). The network device may receive the data that indicates the communication during the time period (e.g., when the power level associated with the second wireless network is modified.

FIG. **5** is a flowchart of an example method **500** for wireless communication. At step **510**, a computing device (e.g., the computing device **104** and/or the wireless device **106** of FIGS. **1** & **2**) may receive one or more attributes of another computing device and/or a network device (e.g., the network device **102** of FIGS. **1** & **2**). For example, the computing device may pair with the another computing device and/or a network device (e.g., the network device **102** of FIGS. **1** & **2**). A pairing request may be received by the network device from the computing device. The pairing request may initiate the pairing. The pairing may occur via a first wireless network (e.g., via the networks **202***a,b* of FIG. **2**). The first wireless network may be a WPAN network. The WPAN network may be a ZigBee network. The pairing may occur via another communication protocol such as Near Field Communications (NFC). One or more attributes (e.g., the device attributes **220** of FIG. **2**) of the computing device may be received during the pairing. The one or more attributes of the computing device may be received by the network device during the pairing.

At step **520**, a plurality of channel bands (e.g., the channel bands **302**, **304**, **306**, and/or **308** of FIG. **3**) that facilitate communication with the computing device may be determined (e.g., by the network device **102** of FIGS. **1** & **2**). The plurality of channel bands may be associated with the first wireless network. The plurality of channel bands may be based on the one or more attributes of the computing device. The plurality of channel bands may have a bandwidth associated with a WPAN.

At step **530**, a concatenated channel band (e.g., the concatenated channel bands **306** and/or **308** of FIG. **3**) comprising the plurality of channel bands may be determined (e.g., by the network device **102** of FIGS. **1** & **2**). The network device may determine the concatenated channel band. The concatenated channel band may have a bandwidth associated with a second wireless network. The concatenated channel band may have a bandwidth of a Wi-Fi network. The concatenated channel band may have an improved Signal to Noise Ratio (SNR) as compared to each of the plurality of channel bands.

At step **540**, data may be received via the concatenated channel band (e.g., by the network device **102** of FIGS. **1** & **2**). The data may be received via the first network. The data may be sent by the computing device via one of the plurality of channel bands. The network device may modify a power level associated with the second wireless network during the time period. The network device may reduce the power level of the second wireless network during the determined time period. The network device may receive data that indicates a communication (e.g., from the computing device). The network device may receive the data that indicates the communication during the time period (e.g., when the power level associated with the second wireless network is modified.

FIG. **6** is a flowchart of an example method **600** for wireless communication. At step **610**, a computing device (e.g., the computing device **104** and/or the wireless device **106** of FIGS. **1** & **2**) may receive one or more attributes of another computing device and/or a network device (e.g., the network device **102** of FIGS. **1** & **2**). For example, the computing device may pair with the another computing device and/or a network device (e.g., the network device **102** of FIGS. **1** & **2**). A pairing request may be received by the network device from the computing device. The pairing request may initiate the pairing. The pairing may occur via a first wireless network (e.g., via the networks **202***a,b* of FIG. **2**). The first wireless network may be a WPAN network. The WPAN network may be a ZigBee network. The pairing may occur via another communication protocol such as Near Field Communication (NFC). One or more attributes (e.g., the device attributes **220** of FIG. **2**) of the computing device may be received during the pairing. The one or more attributes of the computing device may be received by the network device during the pairing.

At step **620**, a time period for communicating with the computing device may be determined. The network device may determine the time period for communicating with the computing device. The time period for communicating with the computing device may be based on the one or more attributes of the computing device received during the pairing. The time period may be based on a time that the computing device will transmit a heartbeat signal. The time period may be associated with the first wireless network.

At step **630**, a plurality of channel bands (e.g., the channel bands **302**, **304**, **306**, and/or **308** of FIG. **3**) that facilitate communicating with the computing device may be determined (e.g., by the network device **102** of FIGS. **1** & **2**). The plurality of channel bands may be associated with the first wireless network. The plurality of channel bands may be based on the one or more attributes of the computing device. The plurality of channel bands may have a bandwidth associated with a WPAN.

At step **640**, a concatenated channel band (e.g., the concatenated channel bands **306** and/or **308** of FIG. **3**) comprising the plurality of channel bands may be determined (e.g., by the network device **102** of FIGS. **1** & **2**). The network device may determine the concatenated channel band. The concatenated channel band may have a bandwidth associated with a second wireless network. The concatenated channel band may have a bandwidth of a Wi-Fi network. The concatenated channel band may have an improved Signal to Noise Ratio (SNR) as compared to each of the plurality of channel bands.

At step **650**, data may be received via the concatenated channel band (e.g., by the network device **102** of FIGS. **1** & **2**). The data may be received by via the first network. The data may be sent by the computing device via one of the plurality of channel bands. The data may be received during the determined time period. The data may be received by the network device during the determined time period. The data may indicate one or more connection attributes associated with the transmission of the data. The one or more connection attributes may be a Link Quality Indicator (LQI), a Relative Received Signal Strength (RSSI), or a Packet Error Rate (PER). The data may be received via the concatenated channel band.

At step **660**, a power level reduction of a wireless network may be determined by a computing device (e.g., the network device **102** of FIGS. **1** & **2**). The power level reduction of the wireless network may be determined by the network device. The power level reduction may be of the second wireless network. The power level reduction may be of a signal and/or communication associated with the second wireless network. The power level reduction may be during the determined time period. The power level reduction may be dynamically determined. The power level reduction may be based on a bandwidth of the second wireless network during the time period. The power level reduction may be based on a quantity of computing devices communicating via the second wireless network. The power level reduction may be based on a quantity of computing devices communicating via the second wireless network during the determined time period. The second wireless network may be a Wi-Fi network. The network device may modify a power level associated with the second wireless network during the time period. The network device may reduce the power level of the second wireless network during the determined time period. The network device may receive data that indicates a communication (e.g., from the computing device). The network device may receive the data that indicates the communication during the time period (e.g., when the power level associated with the second wireless network is modified.

FIG. **7** shows an example system **700** for wireless communication. The network device **102**, the computing device **104**, and/or the wireless device **106** of FIGS. **1** & **2** may be a computer **701** as shown in FIG. **7**.

The computer **701** may comprise one or more processors **703**, a system memory **712**, and a bus **713** that couples various system components including the one or more processors **703** to the system memory **712**. In the case of multiple processors **703**, the computer **701** may utilize parallel computing. The bus **713** is one or more of several possible types of bus structures, including a memory bus or memory controller, a peripheral bus, an accelerated graphics port, or local bus using any of a variety of bus architectures.

The computer **701** may operate on and/or comprise a variety of computer readable media (e.g., non-transitory). The readable media may be any available media that is accessible by the computer **701** and may include both volatile and non-volatile media, removable and non-removable media. The system memory **712** has computer readable media in the form of volatile memory, such as random access memory (RAM), and/or non-volatile memory, such as read only memory (ROM). The system memory **712** may store data such as the communication data **707** and/or program modules such as the operating system **705** and the communication software **706** that are accessible to and/or are operated on by the one or more processors **703**.

The computer **701** may also have other removable/non-removable, volatile/non-volatile computer storage media. FIG. **7** shows the mass storage device **704** which may provide non-volatile storage of computer code, computer readable instructions, data structures, program modules, and other data for the computer **701**. The mass storage device **704** may be a hard disk, a removable magnetic disk, a removable optical disk, magnetic cassettes or other magnetic storage devices, flash memory cards, CD-ROM, digital versatile disks (DVD) or other optical storage, random access memories (RAM), read only memories (ROM), electrically erasable programmable read-only memory (EEPROM), and the like.

Any quantity of program modules may be stored on the mass storage device **704**, such as the operating system **705** and the communication software **706**. Each of the operating system **705** and the communication software **706** (or some combination thereof) may have elements of the program modules and the communication software **706**. The communication data **707** may also be stored on the mass storage device **704**. The communication data **707** may be stored in any of one or more databases known in the art. Such databases may be DB2®, Microsoft® Access, Microsoft® SQL Server, Oracle®, mySQL, PostgreSQL, and the like. The databases may be centralized or distributed across locations within the network **715**.

A user may enter commands and information into the computer **701** via an input device (not shown). Examples of such input devices comprise, but are not limited to, a keyboard, pointing device (e.g., a computer mouse, remote control), a microphone, a joystick, a scanner, tactile input devices such as gloves, and other body coverings, motion sensor, and the like These and other input devices may be connected to the one or more processors **703** via a human machine interface **702** that is coupled to the bus **713**, but may be connected by other interface and bus structures, such as a parallel port, game port, an IEEE 1394 Port (also known as a Firewire port), a serial port, network adapter **708**, and/or a universal serial bus (USB).

The display device **711** may also be connected to the bus **713** via an interface, such as the display adapter **709**. It is contemplated that the computer **701** may have more than one display adapter **709** and the computer **701** may have more than one display device **711**. The display device **711** may be a monitor, an LCD (Liquid Crystal Display), light emitting diode (LED) display, television, smart lens, smart glass, and/or a projector. In addition to the display device **711**, other output peripheral devices may be components such as speakers (not shown) and a printer (not shown) which may be connected to the computer **701** via the Input/Output Interface **710**. Any step and/or result of the methods may be output (or caused to be output) in any form to an output device. Such output may be any form of visual representation, including, but not limited to, textual, graphical, animation, audio, tactile, and the like. The display device **711** and computer **701** may be part of one device, or separate devices.

The computer **701** may operate in a networked environment using logical connections to one or more remote computing devices **714***a,b,c*. A remote computing device may be a personal computer, computing station (e.g., workstation), portable computer (e.g., laptop, mobile phone, tablet device), smart device (e.g., smartphone, smart watch, activity tracker, smart apparel, smart accessory), security and/or monitoring device, a server, a router, a network computer, a peer device, edge device, and so on. Logical connections between the computer **701** and a remote computing device **714***a,b,c* may be made via a network **715**, such as a local area network (LAN) and/or a general wide area network (WAN). Such network connections may be through the network adapter **708**. The network adapter **708** may be implemented in both wired and wireless environments. Such networking environments are conventional and commonplace in dwellings, offices, enterprise-wide computer networks, intranets, and the Internet.

Application programs and other executable program components such as the operating system **705** are shown herein as discrete blocks, although it is recognized that such programs and components reside at various times in different storage components of the computing device **701**, and are executed by the one or more processors **703** of the computer. An implementation of the communication software **706** may be stored on or sent across some form of computer readable media. Any of the described methods may be performed by processor-executable instructions embodied on computer readable media.

While specific configurations have been described, it is not intended that the scope be limited to the particular configurations set forth, as the configurations herein are intended in all respects to be possible configurations rather than restrictive.

Unless otherwise expressly stated, it is in no way intended that any method set forth herein be construed as requiring that its steps be performed in a specific order. Accordingly, where a method claim does not actually recite an order to be followed by its steps or it is not otherwise specifically stated in the claims or descriptions that the steps are to be limited to a specific order, it is in no way intended that an order be inferred, in any respect. This holds for any possible non-express basis for interpretation, including: matters of logic with respect to arrangement of steps or operational flow; plain meaning derived from grammatical organization or punctuation; the number or type of configurations described in the specification.

It will be apparent to those skilled in the art that various modifications and variations may be made without departing from the scope or spirit. Other configurations will be apparent to those skilled in the art from consideration of the specification and practice described herein. It is intended that the specification and described configurations be considered as exemplary only, with a true scope and spirit being indicated by the following claims.

The invention claimed is:

1. A method comprising:

determining, by a first computing device associated with a first wireless network, a utilization of a bandwidth of a second wireless network;

determining, based on the utilization of the bandwidth of the second wireless network, a reduced power level associated with the second wireless network; and

causing transmission of one or more signals, associated with the second wireless network, at the reduced power level.

2. The method of claim **1**, wherein causing transmission of the one or more signals at the reduced power level comprises causing, during a time period the first computing device receives a communication from a second computing device via the first wireless network, the transmission of the one or more signals, associated with the second wireless network, at the reduced power level.

3. The method of claim **2**, further comprising:

determining the time period the first computing device receives the communication from the second computing device via the first wireless network has expired; and

causing transmission of one or more additional signals, associated with the second wireless network, at a second power level greater than the reduced power level.

4. The method of claim **1**, further comprising:

receiving, by the first computing device, one or more connection attributes of a second computing device,

wherein determining the reduced power level is further based on the one or more connection attributes.

5. The method of claim **1**, wherein the first wireless network comprises one or more of a Wireless Personal Area Network (WPAN), Zigbee, Bluetooth, or Wi-Fi, and wherein the second wireless network comprises one or more of Wi-Fi, WPAN, Zigbee, or Bluetooth.

6. The method of claim **1**, wherein the first wireless network comprises a first communication protocol and the second wireless network comprises a second communication protocol and wherein a power level associated with the first communication protocol is lower than a second power level associated with the second communication protocol.

7. The method of claim **1**, wherein determining the reduced power level associated with the second wireless network is further based on a quantity of other computing devices communicating via the second wireless network.

8. The method of claim **1**, further comprising:

determining a time period for communication with a second computing device via the first wireless network,

wherein determining the reduced power level associated with the second wireless network is further based on the time period for communication with the second computing device via the first wireless network.

9. The method of claim **1**, wherein determining the reduced power level associated with the second wireless network comprises determining the reduced power level associated with the second wireless network based on one or more of a signal strength of a communication received from a second computing device or a distance from the first computing device to the second computing device.

10. A method comprising:

determining, by a first computing device and based on data associated with a second computing device, a time period for communication with the second computing device via a first wireless network;

determining, based on the time period, a reduced power level associated with a second wireless network; and

causing transmission of one or more signals, associated with the second wireless network, at the reduced power level during the time period.

11. The method of claim **10**, further comprising receiving, from the second computing device and via the first wireless network, a communication during the time period.

12. The method of claim **10**, further comprising:

receiving, by the first computing device, one or more connection attributes of the second computing device,

wherein determining the reduced power level associated with the second wireless network is further based on the one or more connection attributes.

13. The method of claim **10**, further comprising:

determining the time period has expired; and

causing transmission of one or more additional signals, associated with the second wireless network, at a second power level greater than the reduced power level.

14. The method of claim **10**, wherein determining the reduced power level associated with the second wireless network is further based on one or more of a bandwidth of the second wireless network or a quantity of other computing devices communicating via the second wireless network.

15. A first computing device comprising:

one or more processors; and

memory storing processor-executable instructions that, when executed by the one or more processors, cause the first computing device to:

determine a utilization of a bandwidth of a wireless network;

determine, based on the utilization of the bandwidth of the wireless network, a reduced power level associated with the wireless network; and

cause transmission of one or more signals, associated with the wireless network, at the reduced power level.

16. The first computing device of claim **15**, wherein the processor-executable instructions that, when executed by the one or more processors, cause transmission of the one or more signals at the reduced power level, cause the first computing device to cause, during a time period a communication from a second computing device is received via a second wireless network, the transmission of the one or more signals, associated with the wireless network, at the reduced power level.

17. The first computing device of claim **16**, wherein the processor-executable instructions, when executed by the one or more processors, further cause the first computing device to:

determine the time period the communication is received from the second computing device via the second wireless network has expired; and

cause transmission of one or more additional signals, associated with the wireless network, at a second power level greater than the reduced power level.

18. The first computing device of claim **15**, wherein the processor-executable instructions, when executed by the one or more processors, further cause the first computing device to:

receive one or more connection attributes of a second computing device,

wherein the processor-executable instructions that, when executed by the one or more processors, determine the reduced power level associated with the wireless network, further cause the first computing device to determine the reduced power level associated with the wireless network based on the one or more connection attributes.

19. The first computing device of claim **15**, wherein a second wireless network comprises one or more of a Wireless Personal Area Network (WPAN), Zigbee, Bluetooth, or Wi-Fi, and wherein the wireless network comprises one or more of Wi-Fi, WPAN, Zigbee, or Bluetooth.

20. The first computing device of claim **15**, wherein a second wireless network comprises a first communication protocol and the wireless network comprises a second communication protocol and wherein a power level associated with the first communication protocol is lower than a second power level associated with the second communication protocol.

21. The first computing device of claim **15**, wherein the processor-executable instructions that, when executed by the one or more processors, determine the reduced power level associated with the wireless network, further cause the first computing device to determine the reduced power level associated with the wireless network based on a quantity of other computing devices communicating via the wireless network.

22. The first computing device of claim **15**, wherein the processor-executable instructions, when executed by the one or more processors, further cause the first computing device to:

determine a time period for communication with a second computing device via a second wireless network,

wherein the processor-executable instructions that, when executed by the one or more processors, determine the reduced power level associated with the wireless network, further cause the first computing device to determine the reduced power level associated with the wireless network based on the time period for communication with the second computing device via the second wireless network.

23. The first computing device of claim **15**, wherein the processor-executable instructions that, when executed by the one or more processors, determine the reduced power level associated with the wireless network, cause the first computing device to determine the reduced power level associated with the wireless network based on one or more of a signal strength of a communication received from a second computing device or a distance to the second computing device.

24. A first computing device comprising:

one or more processors; and

memory storing processor-executable instructions that, when executed by the one or more processors, cause the first computing device to:

determine, based on data associated with a second computing device, a time period for communication with the second computing device via a first wireless network;

determine, based on the time period, a reduced power level associated with a second wireless network; and

cause transmission of one or more signals, associated with the second wireless network, at the reduced power level during the time period.

25. The first computing device of claim **24**, wherein the processor-executable instructions, when executed by the one or more processors, further cause the first computing device to receive, from the second computing device and via the first wireless network, a communication during the time period.

26. The first computing device of claim **24**, wherein the processor-executable instructions, when executed by the one or more processors, further cause the first computing device to:

receive one or more connection attributes of the second computing device,

wherein the processor-executable instructions that, when executed by the one or more processors, determine the reduced power level associated with the second wireless network, further cause the first computing device to determine the reduced power level associated with the second wireless network based on the one or more connection attributes.

27. The first computing device of claim **24**, wherein the processor-executable instructions, when executed by the one or more processors, further cause the first computing device to:

determine the time period has expired; and

cause transmission of one or more additional signals, associated with the second wireless network, at a second power level greater than the reduced power level.

28. The first computing device of claim **24**, wherein the processor-executable instructions that, when executed by the one or more processors, determine the reduced power level associated with the second wireless network, further cause the first computing device to determine the reduced power level associated with the second wireless network based on one or more of a bandwidth of the second wireless network or a quantity of other computing devices communicating via the second wireless network.

29. A system comprising:

a first computing device configured to:

determine a utilization of a bandwidth of a second wireless network, wherein the first computing device is associated with a first wireless network;

determine, based on the utilization of the bandwidth of the second wireless network, a reduced power level associated with the second wireless network; and

cause transmission of one or more signals, associated with the second wireless network, at the reduced power level; and

a network device configured to:

receive the one or more signals at the reduced power level.

30. The system of claim **29**, further comprising:

a second computing device configured to:

send, to the first computing device, a communication via the first wireless network,

wherein the first computing device is configured to cause transmission of the one or more signals at the reduced power level by the first computing device being configured to cause, during a time period the first computing device receives the communication from the second computing device via the first wireless network, the transmission of the one or more signals, associated with the second wireless network, at the reduced power level.

31. The system of claim **30**, wherein the first computing device is further configured to:

determine the time period the first computing device receives the communication from the second computing device via the first wireless network has expired; and

cause transmission of one or more additional signals, associated with the second wireless network, at a second power level greater than the reduced power level.

32. The system of claim **29**, further comprising:

a second computing device comprising one or more connection attributes;

wherein the first computing device is further configured to:

receive the one or more connection attributes of the second computing device,

wherein the first computing device is configured to determine the reduced power level associated with the second wireless network further based on the one or more connection attributes.

33. The system of claim **29**, wherein the first wireless network comprises one or more of a Wireless Personal Area Network (WPAN), Zigbee, Bluetooth, or Wi-Fi, and wherein the second wireless network comprises one or more of Wi-Fi, WPAN, Zigbee, or Bluetooth.

34. The system of claim **29**, wherein the first wireless network comprises a first communication protocol and the second wireless network comprises a second communication protocol and wherein a power level associated with the first communication protocol is lower than a second power level associated with the second communication protocol.

35. The system of claim **29**, wherein the first computing device is configured to determine the reduced power level associated with the second wireless network further based on a quantity of other computing devices communicating via the second wireless network.

36. The system of claim **29**, further comprising:

a second computing device,

wherein the first computing device is further configured to determine a time period for communication with the second computing device via the first wireless network, and

wherein the first computing device is configured to determine the reduced power level associated with the second wireless network further based on the time period for communication with the second computing device via the first wireless network.

37. The system of claim **29**, further comprising:

a second computing device,

wherein the first computing device is configured to determine the reduced power level associated with the second wireless network by the first computing device being configured to determine the reduced power level associated with the second wireless network based on one or more of a signal strength of a communication received from the second computing device or a distance from the first computing device to the second computing device.

38. The system of claim **29**, wherein the network device comprises one of a wireless router, a gateway, or an access point.

39. A system comprising:

a first computing device configured to:

determine, based on data associated with a second computing device, a time period for communication with the second computing device via a first wireless network;

determine, based on the time period, a reduced power level associated with a second wireless network; and

cause transmission of one or more signals, associated with the second wireless network, at the reduced power level during the time period; and

the second computing device configured to:

communicate with the first computing device during the time period.

40. The system of claim **39**, wherein the first computing device is further configured to receive, from the second computing device and via the first wireless network a communication during the time period.

41. The system of claim **39**, wherein the first computing device is further configured to receive one or more connection attributes of the second computing device,

wherein the first computing device is configured to determine the reduced power level associated with the second wireless network further based on the one or more connection attributes.

42. The system of claim **39**, wherein the first computing device is further configured to:

determine the time period has expired; and

cause transmission of one or more additional signals, associated with the second wireless network, at a second power level greater than the reduced power level.

43. The system of claim **39**, wherein the first computing device is configured to determine the reduced power level associated with the second wireless network further based on one or more of a bandwidth of the second wireless network or a quantity of other computing devices communicating via the second wireless network.

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